AGRICULTURAL Chemicals

In This Issue

OCTOBER, 1959

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Agricultural Chemicals

This Month's Cover

At the Florida Entomological Society meeting (see story on page 35), the Florida State Plant Board reported discovery of the May Beetle in Miami Beach. Samples of the pest and photographs were exhibited in the State Plant Board traveling exhibit trailer, which was parked across from the hotel.

Vol. 14, No. 10 October, 1959

AGRICULTURAL Chemicals

ARTICLES

FEATURES

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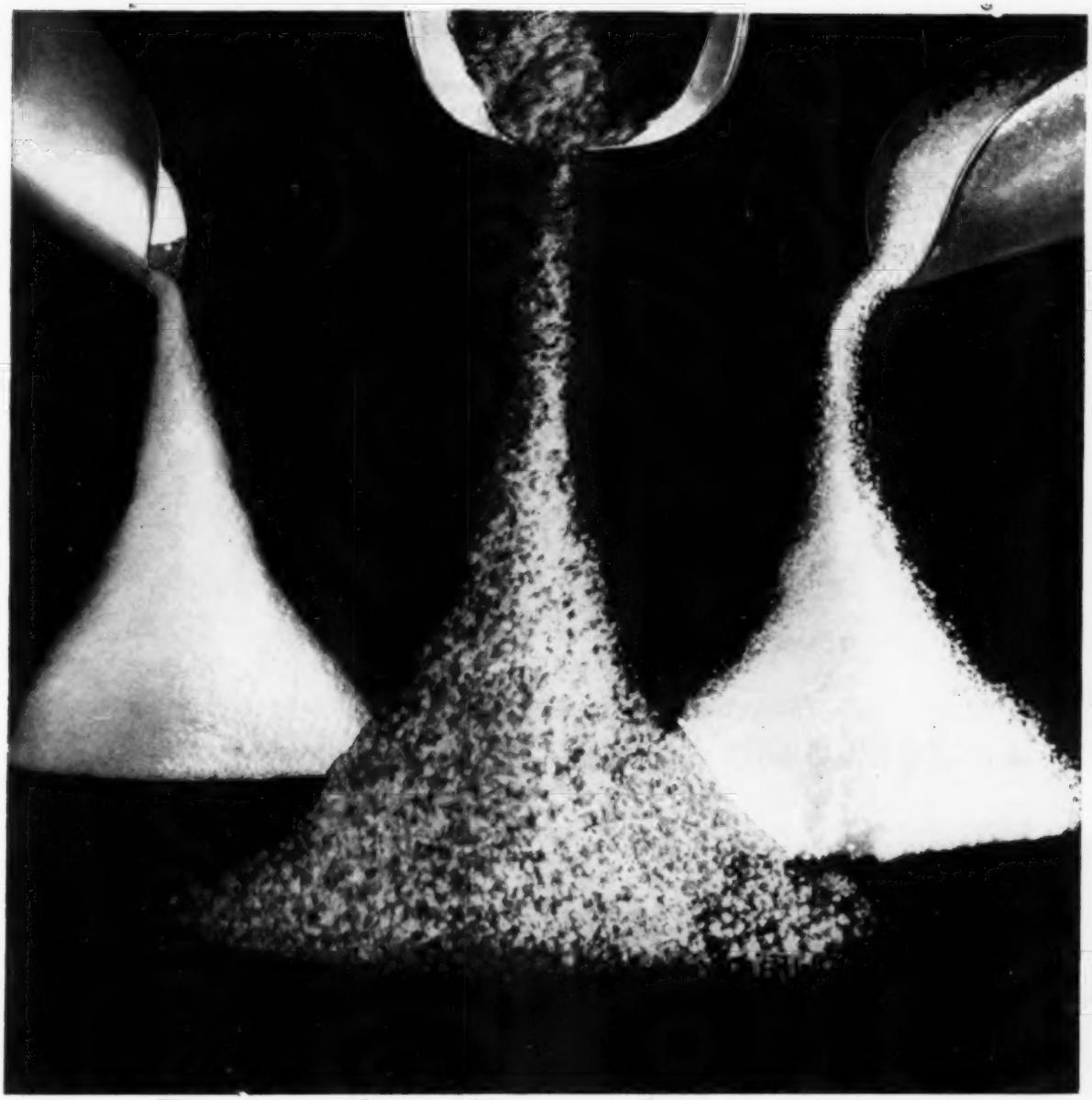

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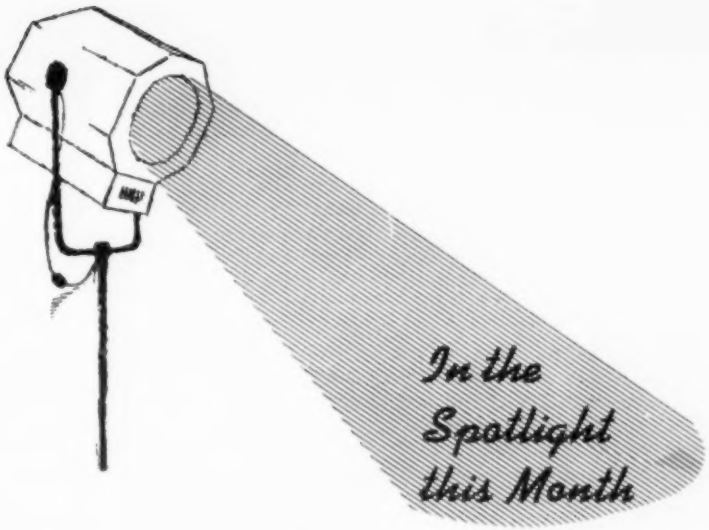

- **Pesticide Residues** . . . Scientists appearing at the ACS meeting agree that no deleterious effects have been demonstrated to human health as a result of use of pesticides,—suggest that tolerances on pesticide residues in milk should be considered by regulatory groups in any realistic approach to pest control. Page 38.

- **Fertilizer Laboratory** . . . A quality control laboratory for under $5000 is described in this article, offering the small manufacturer (one producing 25,000 to 50,000 tons of mixed fertilizer a year), means of determining: moisture content, total nitrogen, total phosphate, free phosphoric acid, soluble potash, and insoluble phosphate. Page 51.

- **A Salesman's Responsibilities** . . . Who is to blame when something goes wrong in connection with a pesticide application,—when damage occurs, or a person is injured? The pesticide salesman often takes the rap, sometimes justly, at other times unjustly. The responsibilities of a pesticide salesman are reviewed by the Chief of the California Bureau of Chemistry. Page 42.

- **Fertilizer Development** . . . In looking to the future, the author discusses the following as channels of research which would lead to fertilizer improvement: Less corrosive fertilizers, slowly soluble potassium, stable suspensions of N,P,K in water, and economic production of organic phosphates. Page 30.

- **Russian Agriculture** . . . The U. S. is well head of Russia in development of equipment, reports P. W. Oman (who has just returned with several other USDA scientists from Russia), . . . however, there are several investigations in which the Russians have progressed further than the U. S., for example in the field of studying insects to determine their ability to survive cold climate. Page 35.

- **The Agricultural Applicator** . . . The section contains an article on the foliar feeding of plants taken from a new book on spraying—a report on the new Piper Pawnee, including a review of its safety features—and a story about the use of chemicals to prune citrus trees. Page 65.

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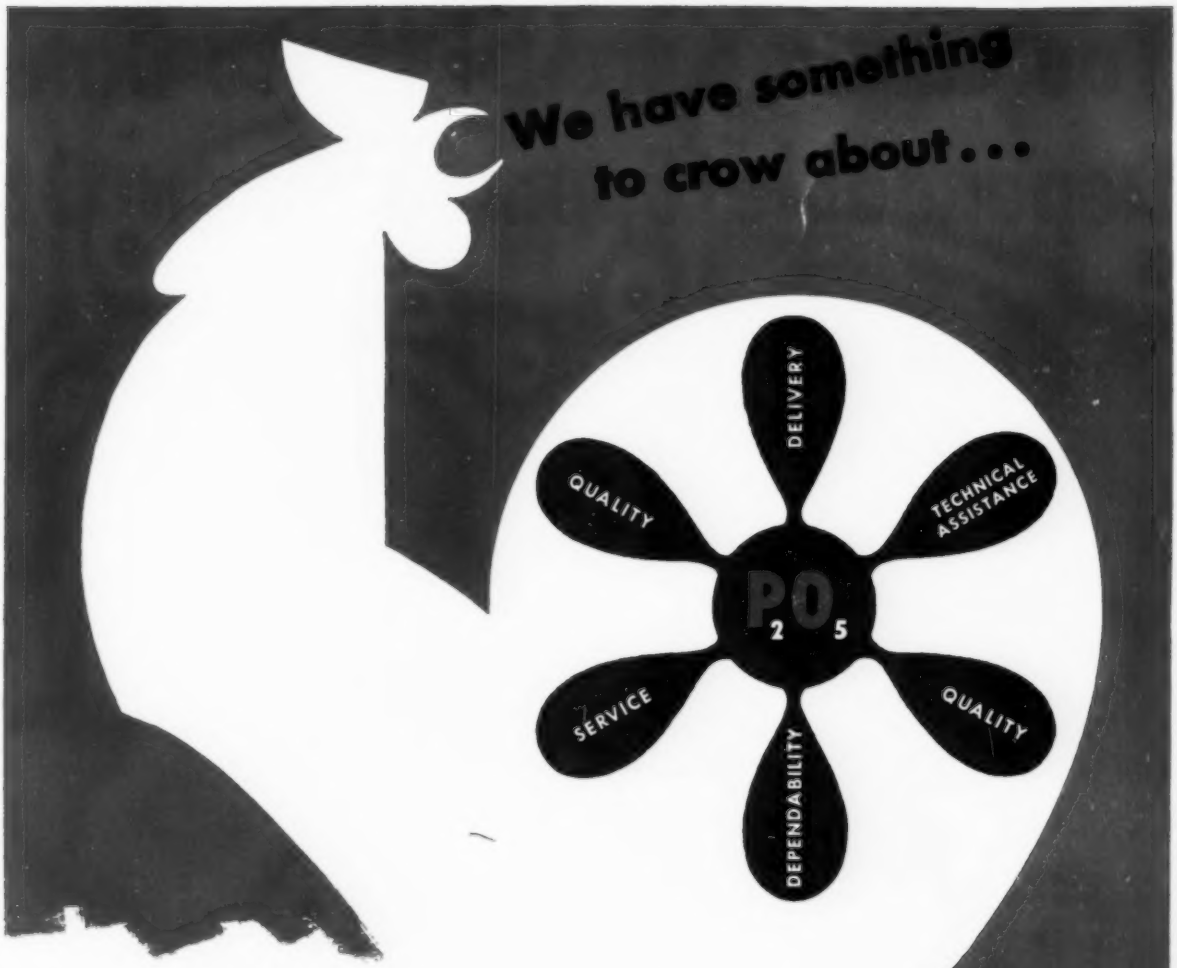

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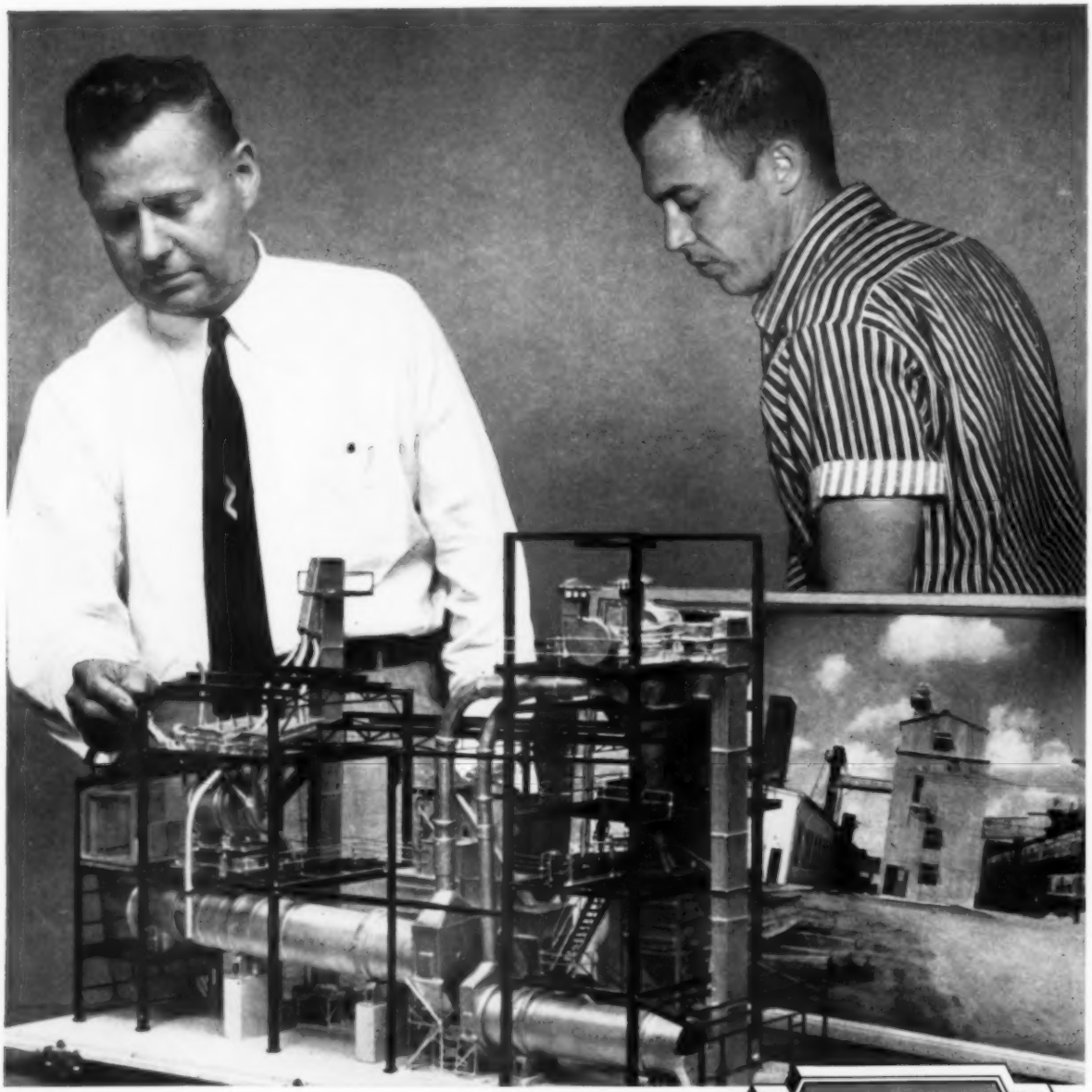

Spearheading the activities of Spencer's Tech Service team is Joe Sharp (left), Product and Marketing Manager for Spencer mixing liquids, shown examining a granulation plant scale model with Bill Yoakam of Spencer's Technical Department. Spencer Tech Service men are trained to assist mixers in engineering, formulation, plant design, granulation, preneutralization and personnel training. A call to Spencer will bring you the services of one of the Tech Service men shown on opposite page.

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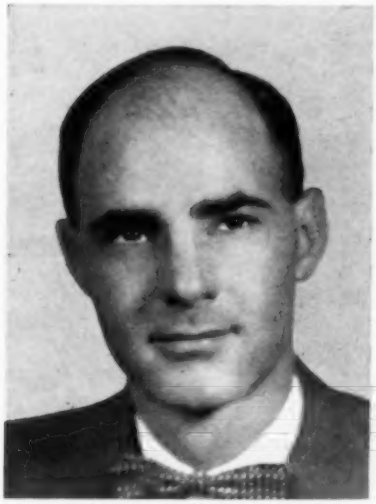

Larry Lortscher—Minn., Iowa, N. D., S. D., Nebr., Wyo. and Mont.

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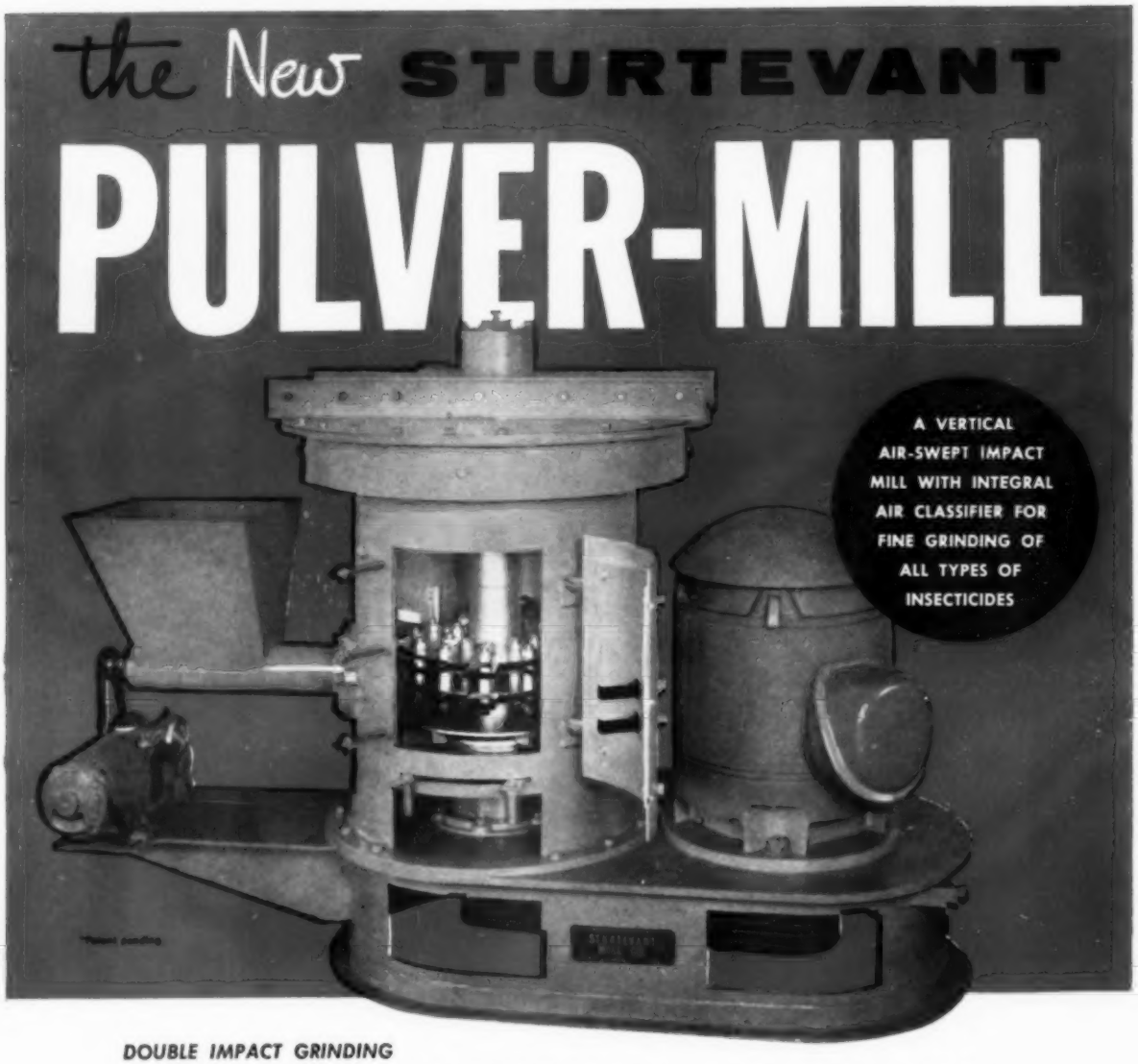

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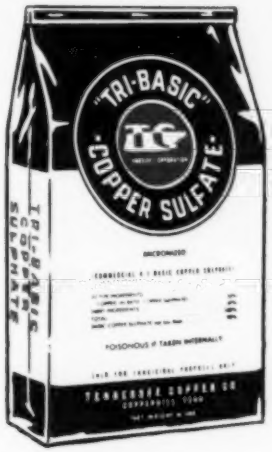

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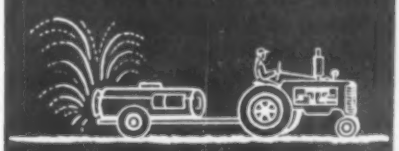

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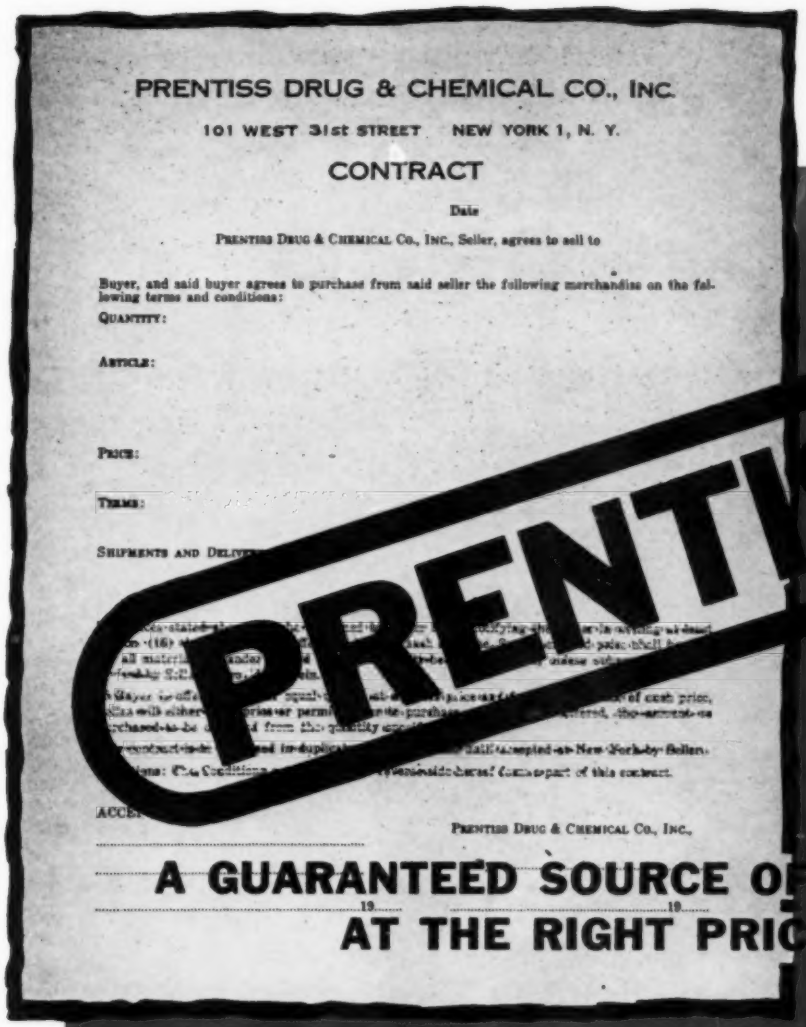
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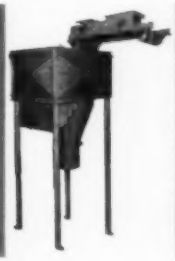

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Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C. William Horwitz, secretary-treasurer.

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California Fertilizer Association, Sidney Bierly, executive secretary, Room 213, Ochsner Building, 719 "K" Street, Sacramento, Calif.

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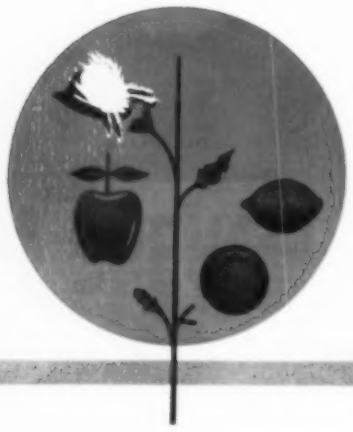

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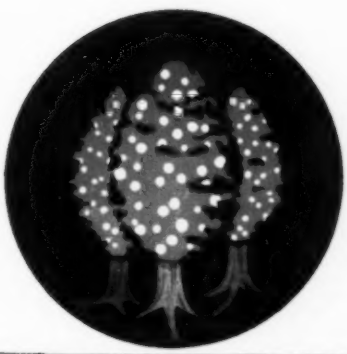

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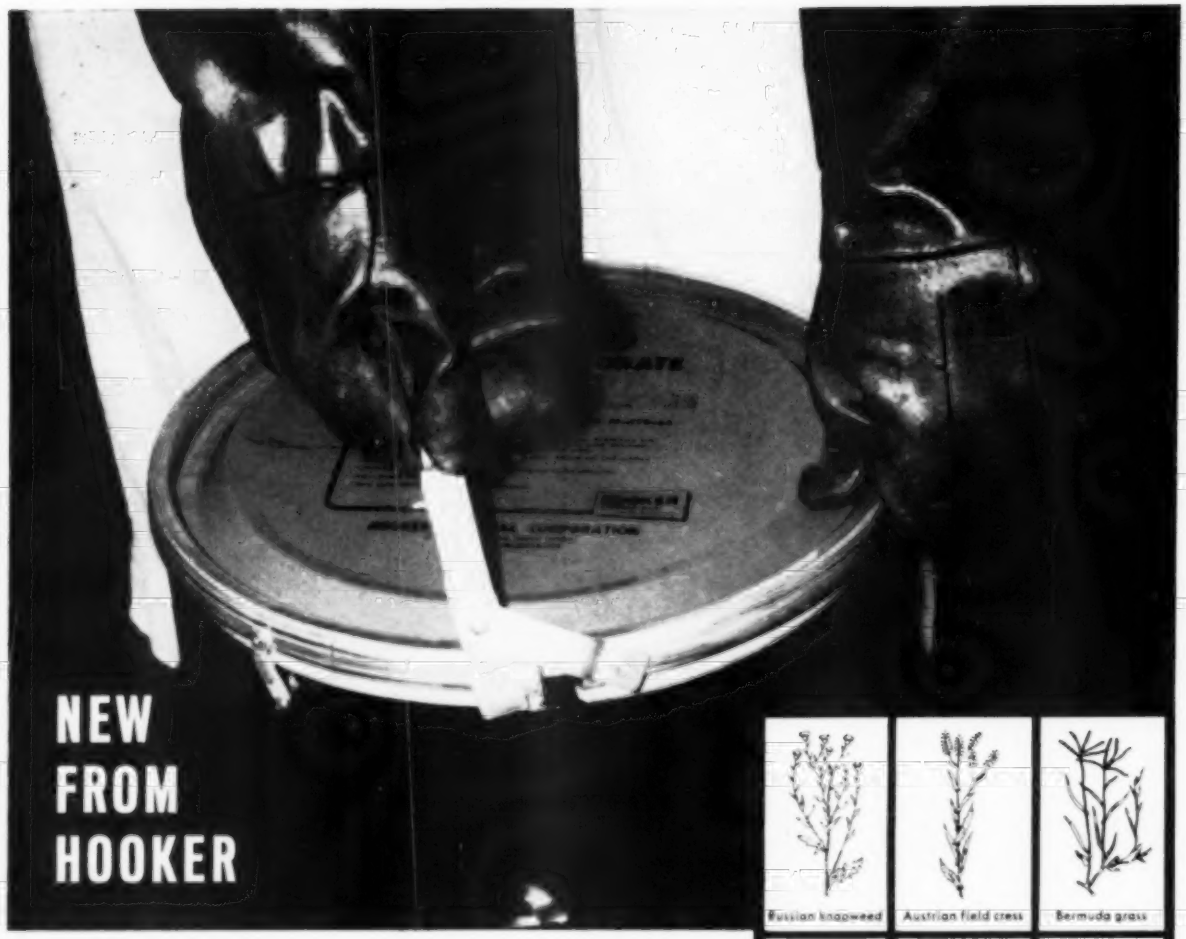

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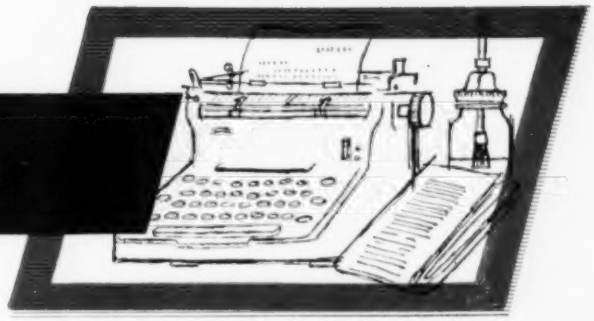
EDITORIALS



AT the recent meeting of the American Chemical Society at Atlantic City, N. J., the subject of pesticide residues as related to possible hazard to human health was given thorough consideration by a panel of leading authorities. The experts who participated in the discussions (See pgs 38-40) were in general agreement that no major hazard exists, contradicting the intemperate and unsupported charges occasionally advanced by those opposed to the use of pesticides that these chemical tools help induce cancer, virus diseases, anemia, etc.

Dr. Mitchell Zavon reported that on the basis of studies at Kettering Institute, and their analysis of findings elsewhere, all evidence to date fails to substantiate these charges. Studies of disease and mortality data, he reported, for years prior to and since the large scale use of insecticides began, "show no evidence of changes in morbidity or mortality which can be attributed to pesticide residues."

Dr. George Decker, in his contribution to the symposium, discounted the charges of those who attack the use of pesticides, and reported that a long list of scientific bodies that have studied the subject agree that "the large scale use of pesticides in the manner recommended by manufacturers and in accordance with rules and regulations applying under existing laws is in no way inconsistent with sound public health". Pesticides, he emphasized, "are here to stay and, whether we like it or not, their use will undoubtedly increase".

The surprising thing to this reporter about the symposium, and the opinions presented, was not the opinions themselves, which are quite familiar to those who have close knowledge of pesticide studies; rather it was the fact that apparently none of the material covered in the symposiums reached the public. We saw not a line in the general press on those carefully prepared and scientifically supported answers to the critics of pesticide use.

When some fanatic charges that pesticides cause "X" disease, or cancer, this is at once a front page item. It is an old story that when the retraction or, in this case, the answer comes out, it is buried somewhere in the back in a four line item. This time the industry seems not even to have the benefit of the brief, buried item.

An obvious reason, of course, for the lack of press coverage of this important symposium was the fact that in the ACS press room there was not a single press release dealing with the symposium. We would suggest that someone blundered here. Here is an important story that should be carried to the public. It represents a tremendous opportunity for favorable publicity which the industry has let slip through its fingers by inaction.

IF our Russian visitor learned anything during his brief stay in the United States, which there is reason to doubt, it could have been that our agricultural economy is tremendously efficient. While in Russia it takes ten workers on the farm to grow the food to support a like number in the city, one worker in the United States can do the same job.

There need be no more convincing testimonial to the great contribution that fertilizers and pesticides have made to strengthening our nation.

Agronomic

"LIME, phosphate and legumes" were key words in soil improvement for much of the cropland of southeastern U. S. prior to World War I. Many of the early conservationists stressed this philosophy where the overriding objective was to establish vegetative cover and give watershed protection. Eventually it became obvious, however, that soil fertility needs of the region called for serious attention to other plant nutrient sources.

Then the tremendous development of the synthetic ammonia industry as an outgrowth of munition plants for World War II opened a whole new field of opportunity. Agronomists, economists, and fertilizer manufacturers began to plan and talk about "cheap" nitrogen. Not only did improved economics of nitric acid production call for a new look at the nitric phosphates but the lowering of cost of chemical nitrogen to the farmer required a re-examination of the legume-nitrogen picture.

A rapidly changing fertilizer technology demanded intensive research and development work on nitrogen. It became obvious that intensive fertilization of a small acreage of intertilled crops on lands adapted to cultivation could be a conservation measure and enable the farmer to protect his rolling lands with close-growing sod crops. Cheaper nitrogen shifted the emphasis from legumes and pointed the way to use of residues of the "grass" crops to maintain organic matter. These shifts in agriculture as a result of changes in fertilizer technology merely illustrate the close relationships between fertilizer research and the sciences of crop production and soil management.

In terms of soil fertility, our longtime needs will depend on whether population pressure forces us to become cereal eaters rather than meat consumers. The followers of Malthus believe this is the only road to survival. These prophets, however, fail to take into account such developments as we have seen in the last decade in efficient meat production—e.g., 1 pound of broiler for 2 pounds or less of feed.

The revolutionary soybean development captured the vegetable oil market and upset the dairy industry; it now threatens competition with meat protein at 35¢ per pound, as compared with $2.50 to $3.00 for meat protein. The soybean plant is a legume, and as such it needs mostly Ca, P, and K, but is quite unpredictable in its response to these elements.

In this age of mechanization, machines versus labor, we need to think more about the effects of fertilizers on farm machinery—a major item of cost in crop production. Who has really tried to make fertilizers less corrosive to application equipment? Why not coat the pellets or granules with protectants to reduce corrosion of metals? Nitrogen solutions account for about ten per cent of all nitrogen used in direct application. Why did this development occur despite high freight rates and lower analysis solutions? It was because labor was saved by pumping and spraying. How far will this development go? Pesek* of Iowa suggests that stable suspensions of N, P, and K in water, to be applied similar to solutions, may have promise. The advantage would be savings in freight costs as the suspensions could be made from solids just before application.

What Form of Nitrogen do Crops Need?

SOME 250,000 chemical compounds containing nitrogen are known to the chemist. Only a very few of these have thus far proved usable because of agronomic availability, cost, and physical condition.

Our thinking in recent years has been dominated by the amazing growth of the synthetic ammonia industry. Since ammonia is the primary and cheapest source of nitrogen, we have given little attention to development of derivatives that might have more desirable agronomic and physical properties.

The first logical step would be to find out if ammonia and its presently available derivatives (chiefly ammonium nitrate, urea, and ammonium sulfate) are ideal carriers of nitrogen, so far as crop production is concerned. For many conditions, they are quite satisfactory, agronomically. However, for sandy-textured soils in regions of high rainfall and on most perennial and long-season crops, these highly soluble chemicals are not very efficient sources of nitrogen. For example, in a comparison of fall versus spring applications of nitrogen for oats grazed in the coastal plain of Alabama, it was found that rates up to 80 pounds of nitrogen in the fall had no effect on grain yield. (Table 1). However, when 40 pounds of N was applied in the spring, each pound of N yielded about 1 bushel of oats.

In this case ammonium nitrate, a highly soluble source of nitrogen, was far from ideal. A fertilizer is needed that, when applied in the fall would release enough nitrogen to produce forage for grazing until about March 1, and then release additional nitrogen to produce a grain crop in June. There is extensive need in the humid region of the Southeast, particularly on sandy soils, for this type of fertilizer. Then too, highly soluble compounds leave undesirable salt effects on plant seedlings as well as being subject to leaching losses.

For any given species, the ideal fertilizer would release the nutrient element in an available form at the

1*Adapted from a report to joint meeting of TVA—State Experiment Station Co-operators and the Fertilizer Evaluation Work Group of the Southern Soil Research Committee, January 22, 1958.

*Personal communication.

Needs in Fertilizer Development

Effect of placement of fertilizer on stand of soybeans. (Left, 400 pounds of 0-14-14 broadcast before planting; right, same fertilizer applied 1 inch to side and below seed.)

by Howard T. Rogers
Department of Agronomy and Soils,
Alabama Polytechnic Institute

time and in the amount needed by the plant. Obviously, completely water-soluble materials fail to meet this criterion. In the case of cotton, one report states that about one third of its nitrogen requirement is needed before the first square forms, another third between this time and the first bloom stage, and the remainder spread out from early bloom to full maturity. About 16 per cent of the nitrogen required is needed after the first boll opens.

Losses of Nitrogen

FOR some time, agronomists have reported difficulty in accounting for all of the nitrogen fertilizer applied to soils under certain situations. Even when leaching was measured in lysimeters and crop removal determined, appreciable amounts of nitrogen could not be accounted for except through gaseous losses. In fact, losses of nitrogen from the soil led to the discovery of the process of denitrification by Gayon and Dupetit in 1882. Denitrification is generally attributed to microbial processes whereby nitrate is reduced to nitrite and under some conditions to N_2 and N_2O. This process is speeded up by high nitrate concentrations and high energy levels. In one study of soils high in organic matter, 80 per cent of the added nitrate was lost from a system aerated at about two per cent oxygen and 16 per cent loss at 19 per cent oxygen.

Recent studies by Gerretsen and de Hoop* show that heavy losses of gaseous nitrogen may occur in strongly acid soils, which are attributed to simple chemical volatilization of nitrogen when ammonium salts are added to acid media containing nitrites in solution.

These observations suggest that a form of nitrogen that would avoid high nitrate concentrations in the soil might be more efficient than ammonia or its readily soluble salts, particularly on strongly acid soils.

Urea-formaldehyde Reaction Products

MUCH effort has gone into producing and testing urea-formaldehyde reaction products. For long-season plants such as turf or sod crops, some of these materials have appeared superior to the highly soluble nitrogen fertilizers. Their cost of production has been a major factor in discouraging more widespread use.

However, for short-season crops like corn and cotton, these materials are not satisfactory. In a series of tests conducted by Scarsbrook* on sandy coastal plain soils in Alabama during 1955 and 1956, two mixtures of urea-formaldehyde with a range in availability index from 20 to 49 were compared with ammonium nitrate.

The curves in Figures 1 and 2 are based on the average of three tests on cotton and four on corn. Obviously the urea-formaldehyde reaction products do not release nitrogen fast enough to supply the requirements of cotton and corn. The question of residual nitrogen

*Gerretsen, F. C. and de Hoop, H. Nitrogen losses during nitrification in solutions and in acid sandy soils. *Canadian Jour. Microbiology* 3:359-380. 1957.

*Scarsbook, C. E. Urea-formaldehyde fertilizer as a source of nitrogen for cotton and corn. *Soil Sci. Soc. Amer. Proc.* Vol. 22:442-445. 1958.

TABLE 1

Fall Versus Spring Applications of Nitrogen on Oats

N, lb/acre		
Fall	Spring	Grain, bu./acre
0	0	19
40	0	16
80	0	22
40	40	54
40	40 (Not grazed)	71
0	40 (Not grazed)	77

Figure 1. Response of cotton to nitrogen from ammonium nitrate and urea-formaldehyde (Mix A).

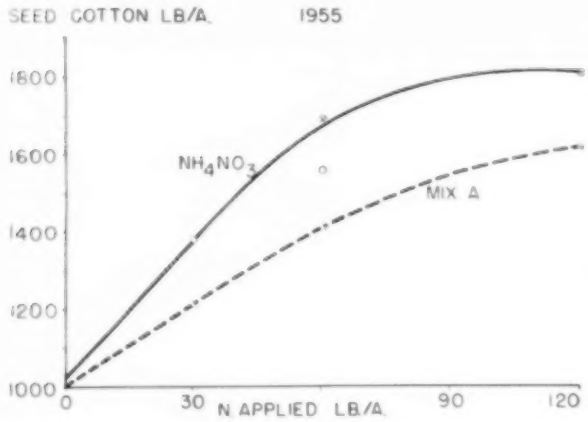


Figure 2. Response of corn to nitrogen from ammonium nitrate and urea-formaldehyde (Mix A).

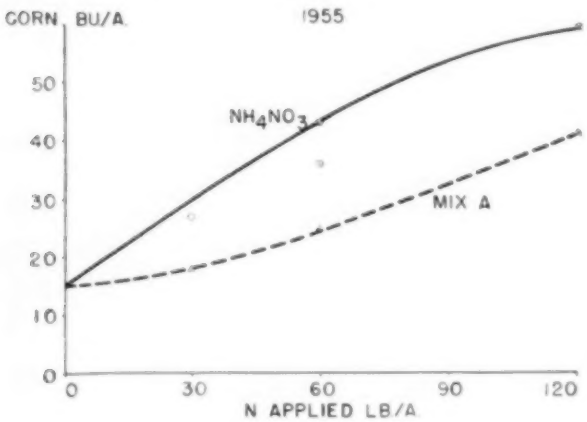


Figure 3. Residual effects on oats of nitrogen applied to cotton from ammonium nitrate and urea-formaldehyde (Mix A).

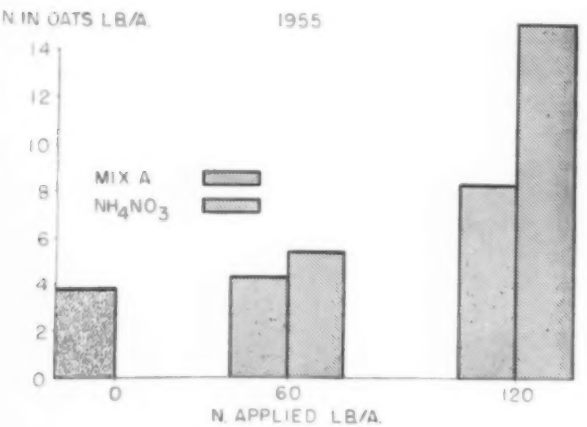


Figure 4. Residual effects on oats of nitrogen applied to cotton from ammonium nitrate and urea-formaldehyde (Mix B).

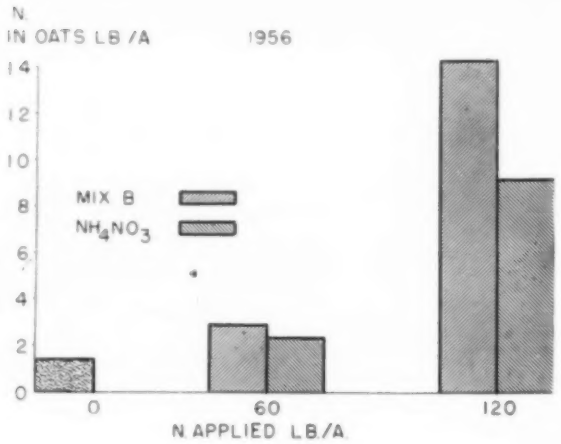


Figure 5. Uptake of potassium by forage species. (Single vertical lines to left of bars indicate minimum percent potassium in plants required for survival. Length of bar shows amount of luxury consumption).

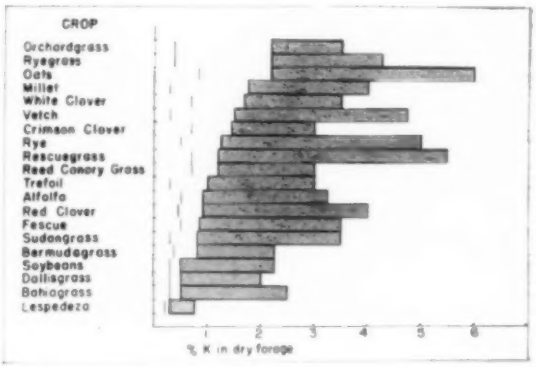
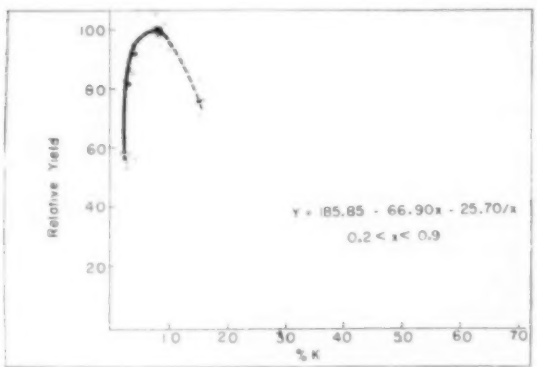


Figure 6. Response of annual lespedeza to rates of potassium as related to % content of dry forage.



left in the soil from applications to cotton and corn was then studied. Oats were planted without further additions of nitrogen at one location in 1955 with Mix A (availability index of 20) and in 1956 with Mix B (availability index of 49) and compared to ammonium nitrate, Figures 3 and 4. At the 60-pound rate of nitrogen, there was no difference. At the 120-pound rate, the urea-formaldehyde mixture with availability index of 20 was inferior to ammonium nitrate, whereas the mixture with index of 49 was superior. However, only about 12 or 13 pounds of nitrogen were recovered in the oat crop under the best conditions.

This research is in the right direction it would appear, but surely some of the many known nitrogen compounds might offer superior properties to the presently available ammonia derivatives.

Phosphorus Fixation

WHEN soil chemists discovered some 40 years ago that soils react with phosphate ions, some agronomists became alarmed at this terrific waste of a natural resource. Probably no other phenomenon in soil science has been investigated so thoroughly as phosphorus fixation. Two soil chemists* who had a talent for dramatizing the complex reactions of the soil described fixation this way:

"I have compared phosphorus in the soil to a monkey in the jungle. One could not throw a monkey far through a thick jungle growth because arms, legs, and tail would soon catch a limb or vine to hang onto. Phosphorus likewise in the soil gets tangled up in many similar ways and tends to be hard to move and to be kept soluble and available.

"To understand this complex chemical behavior, let us pretend that phosphorus is acting in a play as Miss Ortho Phosphate, highly attractive to Mr. Root Hair of the Plant Family. The stage is the soil and the scene of our first act is a very acid room (soil at pH between 4.8 and 5.3). Along the walls of the room (collodial surfaces) are numerous three-handed boys (trivalent, iron and aluminum oxides and hydrates) that have a great attraction for Miss Phosphate, who also has three hands. As long as these Iron and Aluminum boys have Miss Phosphate in this acid ballroom, they can really strut their stuff, and at once they are engaged and married. The marriage is made secure (insoluble in the triple bonds of these hands). The knot is to secure (precipitates of insoluble iron and aluminum phosphates) for Mr. Root Hair to have much of a chance with his courting. He gets jilted and his poor mother, the Plant, starves because her son could not compete with this agressive competition in such an unfavorable environment."

Just how serious is this ability of soils to "fix" phosphorus when measured over a period of years in terms of crop yields and available soil phosphorus. Cotton is very responsive to readily soluble phosphate and is a good test crop for residual phosphorus.

In a test reported by Volk* on Hartsells fine sandy loam, 60 and 120 pounds of P_2O_5 were applied annually from 1930-34 and then discontinued. (Table 2)

TABLE 2

Residual Effects of Superphosphate

(Hartsells Fine Sandy Loam)

P_2O_5 applied annually		Pounds seed cotton/a		
1930-34	1935-55	1930-34	1935-39	1950-55
0	0	1036	783	556
60	0	1437	1192	763
120	0	1483	1299	1083
60	60	1445	1409	1424

Another area received 60 pounds annually for 25 years. The 20-year residual study was started in 1935. Cotton yields were doubled over the no-phosphorus treatment on plots showing residual phosphorus some 5 years after original phosphorus applications were discontinued.

Some agronomists would explain this as being a soil with low phosphorus-fixing capacity. On the other hand, Eutaw clay has an anion absorption capacity equivalent to 21,514 pounds of P_2O_5 per acre. Residual studies were conducted on it by Welch, Ensminger, and Wilson** using in this case Ladino clover. Varying amounts of phosphorus were added over a period of 16 years and then discontinued. One plot continued to receive superphosphates as a check. (Table 3).

In this study 980 pounds of P_2O_5 applied over a 16-year period pro-

*Volk, G. W. Response to Residual Phosphorus of Cotton in Continuous Culture. *Jour. Amer. Soc. Agron.* 37:330-340. 1958.

**Welch, L. F., Ensminger, L. E., and Wilson, C. M. The Correlation of Soil Phosphorus with the Yield of Ladino Clover. *Soil Sci. Soc. Amer. Proc.* 21:618-620. 1957.

TABLE 3

Residual Value of Phosphate on Ladino Cover

P_2O_5, lb./acre		Relative yield
Applied (1934-50)	Soil Test in '54*	Superphosphate in 1954** = 100
0	18	20
980	43	68
1960	138	85
2940	260	94

*Eutaw clay—anion exchange capacity = 21,514 P_2O_5/a.
**Yield with superphosphate in 1954 = 10,691 lb./a.

[1]Scarseth, G. D. and Tidmore, J. W. The fixation of phosphates by clay soils. Jour. Amer. Soc. Agron. 26:152. 1934.

duced 68 per cent as much clover 4 years after discontinuing treatment as did superphosphate applied continuously. Heavier applications yielded 94 per cent as much clover from residual phosphorus as did the soil treated each year. This occurred on a soil with anion exchange capacity of 10 tons P_2O_5 per acre. Availability of this residual phosphorus was further shown by soil test. Unphosphated plots released only 18 pounds of P_2O_5 per acre as dilute acid extractable. Phosphated plots showed soil tests up to 260 pounds four years later.

Look at another crop—vetch—which grows during the cool season of the year. On Greenville fine sandy loam of the coastal plain, Ensminger and Pearson* reported that residual phosphorus from 48 pounds of P_2O_5 applied annually for 15 years doubled the yield over no treatment, and actually produced more vetch than was grown during the years when superphosphate was added. (Table 4). Likewise "A" values,** measured with P^{32}, were increased nearly threefold. Similar values were obtained in a heavier-textured limestone valley soil, Decatur silt loam, with vetch utilizing residual phosphorus from low rates of application 5 years after application and with corresponding increases in "A" values of the soil. (Table 5).

When the full story of residual phosphorus is told, this fixing capacity of soil may be seen as an asset rather than a detriment to long-term needs in soil fertility. This prediction is made in spite of the fact that the need for water-soluble phosphorus appears very important on certain soils of the northwest for vegetable crops and on montmorillonitic clays of the north central states.

One might wonder why all this concern about crop responses to residual phosphorus. It is because much discussion and laboratory research has been directed to finding a form of phosphorus not subject to soil fixation, but usable by plants. It would appear that we have greatly overemphasized the seriousness of phosphorus fixation and might well direct our efforts toward more promising schemes for improving fertilizers.

*Ensminger, L. E. and Pearson, R. W. Residual Effects of Various Phosphates as Measured by Yields, P^{32} Uptake, and Extractable Phosphorus. *Soil Sci. Soc. Amer. Proc.* 21:80-84. 1957.

**"A" values were determined with radiophosphorus and were reported as a measure of the soil's supply of available phosphorus.

TABLE 4. Residual Effects of Superphosphate
(Greenville Fine Sandy Loam)

P_2O_5 applied annually 1930-46	Green weight, vetch 1943-46	Green weight, vetch 1947-50	"A" values, P_2O_5 1950
lb./a	lb./a	lb./a	lb./a
0	4,444	7,432	79
24	9,751	11,505	119
48	10,313	13,238	213

TABLE 5. Residual Effects of Superphosphate
(Decatur Silt Loam)

P_2O_5 applied annually 1930-46	Green weight, vetch 1943-46	Green weight, vetch 1947-50	"A" values P_2O_5 1950
lb./a	lb./a	lb./a	lb./a
0	1,735	3,518	58
24	7,361	5,635	76
48	9,449	8,322	176

TABLE 6. Toxic Effects of K on Peanuts*

*Rogers, H. T. Liming for Peanuts in Relation to Exchangeable Soil Calcium and Effect on Yield, Quality, and Uptake of Calcium and Potassium. *Jour. Amer. Soc. Agron.* 40:15-31. 1958.

Comparison	Yield Difference Average of 15 experiments	Shelling percent difference
O vs. PK	524	2.1
O vs. LPK	591	4.0
L vs. LPK	370	1.8
2LPK vs. 2LP4K	-186	-4.0

The Organic Phosphates

THERE are some 10,000 organophosphates known to chemists. Perhaps less than a dozen of these compounds have been tested for their availability to plants. Several of those tested are either mineralized by contact with soil or root catalysts in the rhizophere, or can be taken up by plants in the organic form. No distinct advantage has been observed for those tested from an agronomic standpoint. The economics of producing organic phosphates competitive with the inorganic carriers does not look promising, since the cheapest organic form at present is estimated to cost about 10 times as much as superphosphate per unit of phosphorus. In spite of this, further attempts to find organic forms that are soluble in water but resist microbial decomposition and can be utilized by plants might be justified.

Potassium Fertilizers

RESEARCH on new potassium carriers has been almost negligible until quite recently. Since the crude potassium ores have been purified to yield readily soluble salts of high concentration and good physical condition, one might conclude that the ideal has been accomplished. To the contrary, this is not the case from the standpoint of economic crop production and the needs of the plant. Luxury consumption of potassium by crop plants is widespread and of no

(*Continued on Page* 118)

A. J. Rogers W. Hunter

A. J. Rogers Succeeds W. Hunter as President Florida Entomological Soc.

AT the 42nd annual meeting of the Florida Entomological Society a variety of subjects were covered ranging from the discovery of a new beetle pest at Miami Beach to a discussion by Dr. Paul W. Oman on pest control in Russia, and a report by Dr. Ted Dobrovsky on the activities of the Food & Agricultural Organization of the United Nations.

Dr. D. O. Wolfenbarger, publicity chairman for the Sub-Tropical Chapter of the Florida Society, announced that the Entomological Society of America has chosen Miami as the site for their 1961 meeting.

During elections at the final business session of the September 10-11 meeting, Andrew J. Rogers, of Vero Beach, was named new president of the Florida Society, and Dr. Lewis Berner, editor of the Society's publication, was elected vice-president. Dr. L. A. Hetrick, University of Florida, was reelected secretary; and Robert E. Waites, Florida Agricultural Experiment Station, will continue to serve a three year term as treasurer. The Executive Committee will be comprised of outgoing president, William P. Hunter of Plant City; G. G. Rohwer, USDA, Winter Haven; and one hold-over member, Dr. John E. Porter of Miami.

Instead of presenting his scheduled paper on taxonomy, guest speaker Dr. Paul W. Oman, president of the Entomological Society of America, substituted a timely report on his 8-week tour of Russia. Using color slides to illustrate his remarks, Dr. Oman reported on entomologist activities, crops, farm equipment, and some general conditions in Russia.

He said that in many respects, the United States is well ahead of Russia, particularly in equipment. Pictures taken by Dr. Oman at the Russian Agricultural Exhibit showed that their best equipment is somewhate inferior to that in the U. S. Dr. Oman said "The exhibit equipment was not as good as ours, and that on exhibit was much better than anything seen in actual use in the Russian fields."

Dr. Oman said that Russia does have an entomological society, but it is state sponsored and under state control, without the freedom known by societies in the United States. He also said that Russia has a definite ruling class made up of bureaucrats who live better than the working classes.

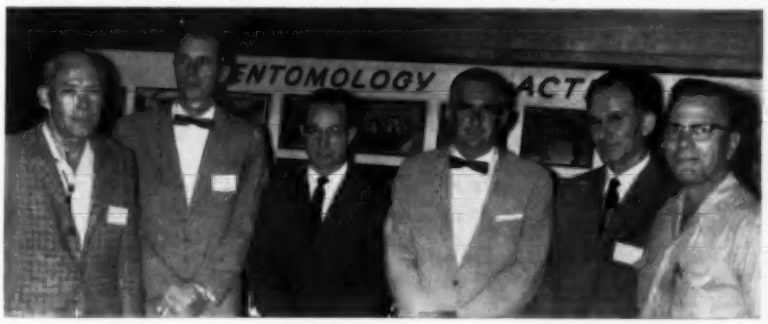
Dr. Oman said, however, that Russia is well ahead of the United States in the field of studying insects to determine their ability to survive winter climate. Information gained from these studies is used for insect control, by making accurate forecasts of distribution and recommended control measures.

In Russia, a Plant Protection Institute is comprised of entomologists and scientists. This group, with headquarters at Leningrad, studies conditions and makes recommendations to the Minister of Agriculture at Moscow. The Minister of Agriculture then makes decisions which are passed on at the farm level where they are implemented without question.

Dr. Oman showed slides of wheat and cotton crops, saying that Russia has no problem with pink bollworm or weevils, their chief cotton problems being aphids and mites.

Another subject of international interest was the report by Dr. Ted Dobrovsky, a former member of the Florida Agricultural Experiment Station, who is now serving with the Food & Agricultural Organization of the United Nations. Dr. Dobrovsky said that the FAO, with headquarters in Rome, is not connected with U. S. foreign aid, but is supported by funds from the 77 United Nations members. Some

Program chairman, F. G. Butcher, University of Miami; chairman of local arrangements, J. E. Porter, USDA Plant Quarantine Division; Paul W. Oman, president Entomological Society of America; newly elected president of the Florida society, Andrew J. Rogers; retiring president, W. P. Hunter; secretary, Lawrence A. Hetrick.



of the projects he mentioned were locust control in North Africa, the study of the olive fly in the Mediterranean countries, wheat and rice pests in the Far East, and a worldwide study of grain storage. He said that approximately 10% of the world's grain is lost to insects, rodents and fungi damage. Another of their projects is the study of legislation pertaining to residues from insecticides and pesticides.

Dr. Wayland J. Hayes, Jr., Chief Toxicology Section, CDC, U. S. Public Health Service, Savannah, Ga., gave a report on the toxicology of commonly used pesticides. Statistics given by Dr. Hayes should help to dispel rumors that vast numbers of the population are being killed off by the use of new pesticides.

Dr. Hayes said "Public concern on this subject is increasing, as it should be, because we are dealing with dangerous materials, but the actual rate of deaths is decreasing, and the deaths that do occur are not primarily from the newer materials. More deaths are still caused by the use of arsenic as a pesticide than by all the new materials combined."

Dr. Hayes said that pesticides are valuable not only in the direct control of disease, but in the production of foods and fibres. He added that the present safety record is good, in view of the great use industry is making of these toxic materials. The industry should of course continue to improve its safety methods. According to Dr. Hayes, there are 90,000 registered pesticide labels, but deaths from barbiturates are six times as high as those from DDT or arsenicals. He said that all accidental deaths from poisons are only .9 persons per 100,000 of population, compared with a national accidental death rate of 56.7 people per 100,000 population. Only 10% of the deaths listed as caused by poisons are caused by pesticides, therefore the accidental death rate from this source is about .09 per 100,000.

Dr. Hayes also reported on occupational hazards in connection with the use of poisonous materials. He said that while the respiratory poisons are more dangerous than other pesticides if absorbed in equal amounts, dermal poisons are picked up at such a vastly higher rate that they are more of a problem.

Problems of particular interest to Florida were covered by a number of speakers. Robert Woodruff, State Plant Board Inspector, reported on the recent discovery of the May beetle (*Phylophaga bruneri*) at Miami Beach. Samples of this new pest and photographs of the damage it causes were on exhibit in the State Plant Board trailer in the park across from the convention hotel. Thousands of the small brown beetles are being found in a four square mile area around Miami Beach and the Miami River. The pest has been discovered on 16 different species of trees. These nocturnal feeders can do a considerable amount of damage to foliage overnight. The potential threat posed by this beetle to crop life has not yet been established, but it is known that the larvae feed on St. Augustine grass and other ground cover.

John W. Wilson, Central Florida Experiment Station, Sanford, gave data obtained over an 11-year period on some of the factors affecting corn earworm control, and results from applications of DDT dust and emulsifiable formulations. These data indicated that if dust formulations are to be used, a 10% DDT dust is required to give satisfactory control. In 1951, good control was obtained with 3 quarts of 25% emulsifiable DDT plus mineral oil in an early planting, and poor control in a later planting. In 1953, 1955 and 1959, four quarts of 25% emulsifiable DDT plus mineral oil produced good results. In 1956 and 1959, five quarts of 25% emulsifiable DDT gave a good control, while the same treatment was considerably poorer in 1954, 1957 and 1958. These data indicate that control with both formulations was erratic. Although poor control was obtained with both dust and emulsifiable formulations in 1957 and 1958, these data do not indicate that the corn earworm is developing resistance to DDT.

Emmett D. Harris, Jr., Everglades Experiment Station, Belle Glade, reported on budworm control studies on sweet corn. His report also indicated some erratic performances from DDT, and he said, "It has become apparent in recent years that these treatments are not controlling budworms effectively."

Later recommendations were a mixture of 2 pounds of 50% wettable DDT powder and 4 pounds of 40% wettable toxaphene powder per 100 gallons of spray. Weekly spray applications were recommended at the rate of 50, 100, and 150 gallons per acre, according to the size of the corn. These applications also proved inefficient.

Better control was obtained with applications adding ½ pound

(*Continued on Page* 111)

Left to right: John W. Wilson, Central Florida Experiment Station, Sanford, Fla., who reported on performance of DDT for corn earworm control; Wayland J. Hayes, Jr., U. S. Public Health Service, Savannah, Ga., who reported on pesticide toxicity; Paul W. Oman, president of the Entomological Society of America, and Emmett D. Harris, Jr., Everglades Experiment Station, Belle Glade, Fla., who reported on experiments to control bud worm on sweet corn.

A survey on:

FINANCING FERTILIZER SALES *with Trade Credit*

FARMERS in the south long have used merchant or trade credit for obtaining operating supplies and, in past years, the fertilizer industry has been a major supplier of trade credit and other services to southern farmers.

Farmers obtain benefits from the practice, according to a report prepared by the Federal Reserve Bank of Atlanta, although the report points out that such credit is sometimes costly. Reporting to farmers of the 6th Federal Reserve District in its periodical, *Bankers Farm Bulletin*, the bank bases its findings largely on data received from 44 firms which manufacture at least 50 per cent of the fertilizer consumed in the Sixth District. The Sixth District is comprised of central and eastern Tennessee, Georgia, Florida, Alabama, and the southern portions of Mississippi and Louisiana.

Trade Credit Practices of Fertilizer Manufacturers
Sixth Federal Reserve District States, May 1959

Credit sales, percent of plants reporting	98
Sales for cash at time of sale, percent of plants reporting	
Less than 20 percent sales for cash	83
Less than 50 percent sales for cash	89
Reasons for extending credit, number of plants reporting	
To obtain more sales	24
Competitors do it	37
Customers expect it	29
Farmers cannot obtain financing from lenders	13
Changes in trade credit to farmers in the last five years, number of plants reporting	
Increased	27
Held steady	16
Decreased	4
Types of credit sales, number of plants reporting	
75 percent or more open-book credit sales	
Direct to farmers	40
Consignment agent	13
Distributor (on own account)	11
75 percent or more secured credit sales	
Direct to farmers	9
Consignment agent	4
Distributor (on own account)	2
Gross margin between cash and time price, average dollars per ton	
Superphosphate	1.54
Mixed fertilizer	2.69
Other fertilizer materials	3.25
Interest rate on extended terms or carry-over balances, percent per year, number of plants reporting	
4 percent	1
5 percent	5
6 percent	37
7 percent	1
8 percent	13
Proportion of credit sales repaid in specific period, number of plants reporting	
70 percent within 90 days	32
70 percent within 180 days	25
Proportion of funds from commercial banks, number of plants reporting	
Under 20 percent	1
20-49 percent	17
50-99 percent	8
100 percent	6
Duration of present credit policies, number of plants reporting	
3 years	3
5 years	7
More than 5 years	42

Financing fertilizer sales with trade credit is an important, widespread practice in the mixed fertilizer industry. Ninety-eight per cent of the fertilizer plants included in the report make credit sales. At the time of the survey each had from 40 to 6,000 accounts; half of the plants had 280 accounts or more. At small- and medium-size plants—10,000 tons to 25,000 tons capacity per year — the accounts were largely farmers. At plants owned by large regional and national firms, accounts included farmers, agents, and wholesale distributors. Credit sales totaled more than 80 per cent of all sales for four-fifths of the respondents. Open-book credit, which most of them gave freely, accounted for at least 75 per cent of the credit sales at four-fifths of the plants.

Manufacturers extend trade credit for fertilizer in two major ways: The small plants usually provide credit directly to farmers in their local trade areas. Large regional firms sell principally through consignment agents. These agents establish credit lines and terms for farmers, sell the fertilizer, distribute it to farmers during the planting season and charge it to their accounts, guarantee payment, supervise the accounts, and collect them. Throughout this merchandising procedure, the manufacturer holds title to the fertilizer and/or the farmer's receivables. Meanwhile, both the agent and the farmer are liable for the debt. By this method manufacturers of mixed fertilizer control their credit extensions as well as the prices charged for their products. Few firms, small or large, sell fertilizer

(*Continued on Page* 117)

Pesticides

A SERIES of talks on the potential danger of pesticide residues in milk and meat highlighted the program of the Division of Agricultural and Food Chemistry at the annual meeting of the American Chemical Society at Atlantic City, N. J., the week of September 13-18. A series of prominent scientists were in close agreement that no deleterious effects have been demonstrated to human health as a result of use of pesticides, and they also indicated their belief that it is rather unrealistic of regulatory bodies to refuse to consider the adoption of tolerances on pesticide residues in milk.

Among the speakers in the symposium was George C. Decker, Illinois State Natural History Survey Division, who presented a paper titled "The Significance of Pesticides Residues in Milk and Meat." He observed that ever since insecticides first began to be used in control of insect pests scientists with direct experience in the field had accepted the fact that under certain circumstances some pesticide residues would invariably be found in milk and meat, and they faced this situation without feeling that it offered any cause for alarm. On the other hand those opposed to the use of pesticides have looked upon the appearance of pesticide residues in meat and milk as "one more ghost, which, when properly dressed with misinformation, suspicion and apprehension, could be paraded before a perplexed and skeptical public as another horrible example of the hazards involved in pesticide usage."

The critics of pesticides have demanded that their use be discontinued, Dr. Decker observed, and have in some cases insisted that the employment of pesticidal chemicals be superseded by the exclusive use of biological control measures. In so arguing, the speaker stated, they have ignored the fact that "for many years biological, ecological, cultural and mechanical control measures dominated all pest control activity, and it was only after such methods proved wholly inadequate to give the degree of pest control expected and demanded by the public that entomologists and others cautiously and reluctantly turned to the use of chemicals." In Dr. Decker's opinion, the fact must be faced that "pesticides are here to stay and, whether we like it or not, their use will undoubtedly increase before there is any significant decline."

Dr. Decker recalled that the public health aspects of the pesticide residue problem have been thoroughly reviewed by a number of scientific bodies including the World Health Organization, the U. S. Public Health Service, the U. S. Food and Drug Administration and the Food Protection Committee of the National Research Council, as well as the committees on toxicology of the American Medical Association. These groups have reached the common conclusion that:

A) The large scale use of pesticides in the manner recommended by manufacturers and in accordance with rules and regulations applying under existing laws is in no way inconsistent with sound public health and

B) Although careless or unauthorized use of pesticidal chemicals might pose potential hazards, there is no cause for alarm.

He commented that when the Miller Amendment to the Food and Drug Act was adopted, a system was set up providing for the establishment of tolerances for pesticide residues on raw agricultural commodities and there was no specific exclusion of either meat or milk. Actually there is an officially established tolerance for DDT in the fat of cattle, hogs and sheep,—the upper acceptable limit being 7 ppm. At various times petitions have been presented requesting the establishment of a tolerance for various insecticides in milk but all such petitions were withdrawn before any final action was taken. Thus, there is no established tolerance for any pesticide in milk.

In Dr. Decker's view the problem of residues of pesticide in meat is a comparatively simple one. For all practical purposes, he believes, meat is simply another raw agricultural commodity and it would simply be necessary in establishing a residue tolerance to determine the dosage-time-residue relationships, evaluate the toxicological hazards, and after comparing the two, establish a sound, safe, and reasonable tolerance. He recognizes that milk presents quite a different and more acute problem because of its unique position as the principal item in the diets of infants, the infirm, and the aged.

Nevertheless, Dr. Decker feels that "there seems to be no valid scientific or moral reason why it (milk) should be set apart as something to be worshipped like the sacred cow of India, if the establishment of safe tolerances falls within the realm of possibility." There are many competent scientists, Dr. Decker reported, who feel this can and should be done and in his opinion a duly established tolerance at some level, including zero, when necessary, is more easily enforceable than no tolerance at all. He sees the problem as more psychological than biological in nature and asked, "Do we have the wisdom, the intestinal fortitude, and the moral courage to stand up and face the problem squarely and fearlessly and to resolve it solely on the basis of its scientific merit, or will we continue to bury

Get Clean Bill of Health at Pesticide Residue Symposium

at A.C.S. Meeting held September 13-18

our heads in the sand or hide behind smoke screens and pretend it does not exist?" He concluded that, in view of the unwillingness of any agency to take the responsibility of approving a tolerance for pesticide residues in milk, "there is little likelihood we we will soon, if ever, have an officially established tolerance for any pesticide in milk."

Turning to the equally baffling and controversial topic of pesticide residues on feed and forage crops, Dr. Decker noted that this problem is particularly acute because forage moving in interstate commerce may go to any consumer, with no advance knowledge of its ultimate destination. Thus it must be regarded as potential feed for dairy animals. If the feed supply of dairy animals must be protected, Dr. Decker observed, it follows logically then that "There can be no established tolerance for a pesticide on a forage crop unless it has been established that the amount designated will not result in the contamination of milk."

He indicated that in his opinion tolerances alone are hardly the answer to this problem, since a very large percentage of all feed and forage crops never leave the farms on which they are produced. Education, he believes, is a much more realistic answer to the problem and "attempts to wholly prohibit many valid and practical uses for pesticides on all forage and feed crops, on the vague presumption that a small fraction of the crop so treated might conceivably eventually reach dairy animals, will prove futile, and such prohibition was most certainly not the intent of the Congress which passed the Miller Bill."

Education of producers and users, the speaker said, is the only possible solution to another problem, the hazard of pesticide residues in connection with the conversion of fruit and vegetable by-products such as corn silage, apple pomace, citrus pulp, etc., into animal feeds. He believes that it would amount to a usurpation of powers beyond the intent of Congress for any government agency to prohibit the use of pesticides that would protect a crop merely because some by-product might find its way into dairy food.

In conclusion, Dr. Decker observed that "This question of what constitutes inconsequential levels of chemicals in foods is one that has been cussed and discussed in a wide variety of scientific circles. At the moment there seems to be general agreement on several points. (1) For every compound there is a level of intake below which there is no discernible effect upon health. (2) Each compound will have to be considered on the basis of its particular physical, chemical and toxicological properties. (3) An arbitrarily selected fraction of the safe dose should not be used to define the upper limit of a zone of inconsequence for all materials. (4) Chemicals in food production and processing may occur in foods in amounts so small as to be inconsequential in relation to public health and in such instances, regulatory action is not required.

"In the last analysis the most significant of all the unsolved meat, milk, and forage residue problems seems to be, who is going to assume the responsibility for making positive decisions on in-

consequential levels of food or feed contamination? If one can assume that when the Congress grants broad quasi-legislative powers to federal agencies, it expects them to make some positive as well as negative decisions, then we may hope that the it can't be done attitude of the past may soon be replaced by It can be done, We are going to find out how, and We are going to do it."

No Deleterious Effects

Mitchell R. Zavon, assistant professor of industrial medicine, at Kettering Laboratory, University of Cincinnati, offered an answer to the question, " Do Pesticide Residues in Milk and Meat Affect People?" He commented that accusations of injury from pesticide residues have often been intemperate and without basis in careful observation. Evaluation of available data for years prior to and since the large scale use of insecticides began show no evidence of changes in morbidity or mortality which can be attributed to pesticide residues. In one of the few controlled studies that have been conducted on a group exposed to pesticides for a prolonged period of time, Dr. Zavon reported, DDT fed to a group of volunteers for a prolonged period caused no detectable effect.

The U. S. Public Health Service, he added, in 1937 examined a large number of persons exposed to lead arsenate. "No evidence was found that ill health was any more prevalent in that region than elsewhere nor that any cases of chronic disease had been caused or influenced by lead arsenate exposure."

Ortelee in 1958 found no correlation between prolonged intensive occupational exposure to DDT and frequency or distribution of clinical abnormalities.

"It is impossible to prove the negative," Dr. Zavon conceded. However, all evidence available to date fails to substantiate charges that pesticide residues cause aplastic anemia, lymphoma, leukemia, psychoneuroses, virus-like disease, and a multitude of other ailments."

He presented the following conclusions based on extensive studies at Kettering Institute::

1. No deleterious effect in man has been shown to result from pesticide residues in milk and meat.
2. Until our methods of clinical evaluation become far more refined we will probably be unable to detect effects from the residues presently found.
3. At present there is no evidence of effect on man from the long term ingestion of pesticide residues in milk and meat.
4. Quantitative studies to determine the actual exposure of the human organism to pesticide residues would be highly desirable when the necessary analytical techniques are available.

Urges Tolerances For Milk

"Safe Tolerances for Pesticides in Milk" was the topic of another paper in the symposium presented by John P. Frawley, Hercules Powder Co. We accept on the basis of long history, Mr. Frawley observed, that many chemicals appear normally in milk, such as arsenic, fluorine, manganese, etc. Yet we fail to permit the presence of other chemicals in milk, — chemicals for which there is far greater scientific evidence for establishing their safety. For quite a number of our pesticides, he believes, there is sufficient data to establish safe levels for humans as well as for experimental animals.

Undoubtedly concentrations of contaminants acceptable in milk should be lower than in any other food because of the greater consumption of milk, and because of wide use of milk by infants, in Mr. Frawley's opinion. "However," he added, "undue concern is inconsistent with scientific facts, since the average infant born in recent years has already demonstrated its lack of extraordinary sensitivity to various chemicals by surviving an *in utero* exposure to these materials (e.g. pesticides) from the dosages permitted in the foods ingested by the mother."

Conservatism is justified in the interpretation of safety of chemicals appearing in milk for human consumption. Sufficient information is currently available, however, the speaker stated, on a number of chemicals, especially pesticides, to permit scientists to make positive recommendations for tolerances in milk which are safe beyond any reasonable doubt, and perhaps even safer than some of the natural constituents of milk.

"Continued acquiescence to the demands for absolute proof of safety of pesticides in milk will perpetuate the 'no tolerance in milk' philosophy and prolong and augment the educational and public relations problems in future years by suggesting that a relaxation of safety requirements has occurred, if and when a change in the present status is finally decided upon."

Pesticide Residue Determination

W. E. Westlake, of the Agricultural Research Service, USDA Beltsville, Md. presented a paper on "Problems and Trends in Determining Pesticide Residues in Milk and Meat". He reported that excellent progress has been made in developing methods and securing data on pesticide chemical residues in milk and meat. Nevertheless we are still lacking in analytical methods which are reasonably rapid, and which can be routinely used in any properly equipped laboratory without extensive revision. Our efforts to develop more sensitive procedures are not being applied in the most efficient manner due to the lack of a definite philosophy on this point.

The current trend in pesticide residue analysis, he reported, is toward the increased use of instrumentation, due largely to the development of new and improved instruments with application in the

(*Continued on Page* 110)

SELLING FERTILIZER . . .

Full customer service, including assistance in: market analysis, sales training, credit, insurance, technical service, etc., is the basis of IMC's expanded marketing program.

FULL line sales and full line service — that's how International Minerals & Chemical Corporation describes its expanded marketing program for agricultural chemicals.

Key to the 1959-60 program is the new Agricultural Chemicals Division (story in July Agricultural Chemicals, page 68), which expresses the company's broadened viewpoint toward the full range of customers' fertilizer manufacturing problems.

Everyone concerned with any phase of selling, — whatever the product — knows full well that a prospect can most easily be turned into a customer by helping him with any of the problems that may be bothering him, regardless of whether they have anything to do directly with the product being sold. But far too often, the average salesman is inclined to avoid these "nuisance" problems of his potential customers, — concentrating on his interest which is getting a signed order, — rather than the problems uppermost in the customer's mind at the moment, which may have no immediate connection with purchasing. There is often that tendency to try to make the sale with minimum effort, with minimum service, — by phone if it can so be done. And, there always are such other tired substitutes for salesmanship as "reciprocity", price cutting, or relying on a "we're members of the same club" relationship.

International Minerals appraised its whole sales approach, and in May, 1958, initiated a program that emphasized *full service* for its customers. The "Full Orbit" program is being expanded and extended to give further impetus to sales.

Every IMC saleman, in addition to his role as a representative for the full line of IMC products, is also trained to offer his customers assistance in: • Market Analysis, • Sales Management, • Sales Training, • Sales Meetings, • Advertising, • Insurance, • Credit and Collections, • Safety, • Transportation, • Technical Service.

These services, intelligently applied, equip IMC customers to compete on favorable terms with any of their competitors, and help them to sell an increasing tonnage of finished product to a growing market. While obviously not every IMC salesman can be an expert on every topic, he is still in position to offer the combined experience of a long list of experts qualified to advise on essentially any problem that can arise in the conduct of a plant food business. Typical services include the following:

• Market Analysis—Studies on size, potential, brand acceptance, realistic sales goals, where to aim production, how to build a tailor-made sales staff.

• Sales Training — Sales Management—Sales Meetings. How to arm salesmen with the "plusses" that make sales 'click', determining manpower needs, holding sales meetings, developing the sales approach, and building a more productive staff.

• Credits and Collection. IMC works with its customers to help them understand sound business practice in establishing credit; methods of determining risk; how to handle credit paper; sell through credit; how to restrain customer credit; how to handle past due accounts; consider the debtor; establish a fair but insistent collection policy; and how to suit collection policy to the *fertilizer* trade.

• Insurance and Safety. Facts and fundamentals of setting up in-plant insurance and safety programs; employee insurance.

• Transportation. IMC offers its customers aid in taking their freight cost problems to rate control boards, works through associations, or tries to help solve the problem independently.

• Plant Location Studies. Analysis of plant site, considering such factors as proximity to major sales area, location on a waterway, to take advantage of low-cost barge shipments, etc.

• Technical Service. Technical help with acidulation, formulation and production processes; equipment, engineering, and research.

• Advertising. IMC aids its customers in getting the most out of promotional dollars,—starting with budgeting for newspapers, radio and TV. The service includes counseling on some of the mechanics of advertising.

The IMC salesman is still selling potash and phosphates, but he is also a man to whom his customers may turn for full assistance in any phase of their operations. His knowledge of the fertilizer industry (manufacture and application) is quite adequate to allow him to handle directly many simple problems (merchandising and technical) of the dealer, mixer and farmer. In more complicated situations, IMC's home office experts are called in.

Obviously the Full Orbit Service program required consider-

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Responsibilities of a Pesticide Salesman

*by Robert Z. Rollins**

Chief, Bureau of Chemistry
California State Department of Agriculture

USUALLY the question of who is responsible for a pesticide application comes up only when something has gone wrong. At such a time, the farmer may maintain that he can't keep up with the complicated field of pest control or remember the characteristics of all the new chemicals, and that he has relied on the salesman, or someone else, to know what to do. The pest control operator may maintain that his job was merely to accept what was delivered to him and to apply the material when and where he was told. The salesman may maintain that his job has merely been to deliver an effective pesticide that is properly formulated and meets its guaranteed analysis. With each of the three pointing at the other two, what is each one responsible for, or who is really responsible?

Hundreds of pesticide sales are made each day, and probably each case presents a little different situation. We are not at the moment particularly concerned about the girl in a notions store who sells a package of moth balls, the grocery clerk who rings up sale of a can of fly spray, or the pet store that sells a package of flea powder. There are many kinds of pesticides and many kinds of pesticide salesmen. We are particularly concerned now with sales of agricultural pesticides for large-scale applications, but even these present greatly differing circumstances. In some cases, the farmer has decided what he wanted done, told the salesmen or operator just what he wanted delivered and told the operator where and when to apply it. In other cases, the farmer has left his pest control problems entirely in the hands of the salesman, or occasionally in the hands of the operator to do whatever he thought necessary. So the roles played by farmer, salesman, and operator differ greatly in different cases. Obviously responsibilities must also differ greatly. Responsibilities of each of the three persons concerned differ in any one case, and the responsibilities of the salesman, for example, differ in each case in which he is involved.

You can see that we are finding things a litle complicated, trying to determine the responsibilities of a pesticide salesman. Furthermore, the concept of a responsibility is frequently a moral one, and we can get way over our heads in a short time if we start to outline what a salesman's morals should be.

However, we often use the idea of responsibility in another way. We say we are held responsible to drive our car legally, or we may lose our driver's license. We are held responsible to pay our taxes. We recognize that we are responsible to pay our taxes. We recognize that we are responsible to meet a number of obligations, and that if we don't, we are in trouble. In this sense, a responsibility is something we may be called upon to answer. It is this concept that we want to explore. Let us say, therefore, that the responsibilities of a pesticide salesman are the things he may be called upon to answer: the things for which he may be held accountable.

This is a most appropriate concept. As we observed at the outset, the question of responsibility comes up when something has gone wrong. Damage has occurred or a person has been injured, and someone is looking for someone else to pay for the loss. Farmers are notoriously poor, pest control operators are not spectacularly wealthy, but it is popularly believed that pesticide manufacturers have money to burn. Consequently, when a bill is to be settled, everyone looks hopefully at the pesticide salesman. He is what insurance men call a target risk. He is frequently blamed, justly and unjustly, for mishaps with

*Presented at New Pesticides Review for Central California, sponsored by Western Agricultural Chemicals Association, Fresno, September 10, 1959.

pesticides, and is expected to pay the costs. He is frequently called to answer for an accident, which is another way of saying that proper use of a pesticide is commonly regarded as his responsibility.

The broad interpretation of the responsibilities of a salesman, the fact that he is so frequently blamed for accidents involving pesticides or for their failures, is really a recognition of the important role he plays in use of these important chemicals. All surveys of factors influencing farmers' use of pesticides agree on the predominant place of the salesman over "official" recommendations, technical literature, and other sources of information. He is expected to know what they will do and what they will not do, and consequently he is expected to know their capability of causing trouble.

Most of the complaints made about pesticide salesmen do not charge them with deliberate misrepresentation, which is a misdemeanor according to Section 1066.1 of the Agricultural Code and punishable as such, but rather they charge salesmen with failure to point out hazards, to make clear some of the possible things that can go wrong with their products. They charge him with sins of omission, and failure to do a full job, an unawareness of his responsibilities.

If a salesman wants to know what might in any case be regarded as his responsibility, he can get a pretty good idea by thinking about everything that can possibly go wrong. If he knows what can go wrong, he can make sure that the hazard is understood by the person that he regards as responsible in a particular instance. In many cases, it is discovered too late that the opportunity or likelihood of the accident occurring was not foreseen by the farmer, the operator or the salesman. So ample consideration of what can or is apt to go wrong in any application may remind everyone of what might later be regarded as his responsibility.

With this in mind, what are some of the things that can go wrong in a pesticide application? Let us present some of these in the form of questions.

Legal Requirements

Does the pesticide meet legal requirements? Has the label been accepted and the product been registered?

Is it being delivered in an original unbroken package with a proper label? Delivery of material in an improperly labeled container, delivery of a remnant of material left over from a previous job, or any other irregularity in packaging leaves the material wide open to suspicion. Incidentally, it's a good idea to reread labels occasionally, and not to take them for granted. It is sometimes surprising to find something there that had been completely forgotten since it was first read several seasons earlier.

Is the pesticide subject to any special requirements? If it contains a chemical classed as an injurious material or an injurious herbicide, has the necessary permit been secured from the county agricultural commissioner and has the user provided a signed statement that he has a permit and given its number?

Does the proposed application conform with county regulations and county recommendations? These requirements and recommendations differ in different counties. A salesman should be familiar with the ones in the particular county where the material is to be used.

Has the product been registered for the particular use in question? If it has not, a pest control operator cannot apply it unless the farmer gets a special authorization from the commissioner.

Recommendations

Is the proposed usage in accord with the recommendations and precautions on the label? If it is not, a salesman should give the matter a little more thought to be sure he is right.

Is the proposed application at variance with recommendations of the State Experiment Station or the U. S. Department of Agriculture? A salesman can be different and still be right; but if he is different and something goes wrong, he might find it difficult to justify himself.

The Pest

Is the pest present? This is not as silly as it might sound. Among the charges leveled at salesmen is that they have recommended an application for aphis before the aphis have arrived in suitable numbers, or an application for cabbage looper before the worms have appeared may be ineffective. On the

The salesman has the predominant role in influencing the farmers' choice as to what pesticide to use,—when and how to apply it. His advice often takes priority over "official" recommendations, technical literature, etc. And he is the man the grower holds responsible if something goes wrong

other hand, delaying application until the aphis have curled the leaves or cabbage loopers have become nearly fullgrown may also fail to control. Proper timing of a pesticide application can be very important.

Is control of the insect pest at this time economically desirable? It is sometimes said that control of an insect was not really needed in a particular instance, and critics of a salesman say the pest was reaching the end of its destructive period, or that predators or parasites were establishing adequate control when the salesman recommended treatment. For example, an infestation of russet mites beginning late in the season on tomatoes may not require treatment at all.

Is the formulation effective for this pest? Sometimes a dust is effective but a spray is not, or vice versa. A formulation with oil might be effective when a wettable powder is not.

Honeybees

Will the material injure honeybees on the crop plant to be treated? Certainly a salesman should know what effect his products have on honeybees. He should be familiar with the grouping of chemicals according to their hazards to honeybees.

Will it injure honeybees on an interplanted crop or cover crop or on bordering flowering weeds? Occasionally there have been cases where the crop primarily treated was not in bloom, but the pesticide caused severe losses of bees working in other blossoms incidentally poisoned by the spray.

Does this application require notification of beekeepers? If a salesman has any doubt he should check with the county agricultural commission for the requirements in the particular county.

Livestock

Will the material injure livestock that might be admitted to the property after treatment? If the pesticide is a persistent type, it might present a hazard to livestock for some time after application.

Will the material be detrimental if crop residues are fed to livestock? This has become an important and common problem. Mere traces of DDT and many other pesticide chemicals on the feed of livestock can contaminate milk or meat with illegal residues. Sweet corn stover is usually so contaminated with pesticides that it cannot be used as feed. Pea vines, beet tops, and cotton trash may be similarly unfit for feed when treated in certain ways. In treatment of almonds, for example, a choice may be made between pest control programs, depending upon whether or not the hulls are to be used as feed. If a certain pesticide imparts an unacceptable residue on the hulls, the salesman should make sure that the farmer knows it beforehand.

Persons

Is this application apt to cause trouble by drift into houses in the treated area? Occasionally an application of a certain chemical cannot be made because the planting surrounds a house in which people are living. In such cases, a strip around the house may have to be left untreated, or treated in some other manner, or arrangements may be made for the people to vacate the premises for a suitable period of time. Sometimes, where the injurious material is concerned, the agricultural commissioner may make this a condition of the permit.

Does this application present any hazard to women in the treated area at the time of application? It is a poor excuse for a salesman to claim, after an accident, that he thought someone else was going to see that everyone was out of the orchard when treatment was made. If the premises have to be vacated, he should make sure everyone knows this.

Does it present any hazard to workmen, such as pickers, irrigators, and others, who may enter the treated area shortly after treatment? If there is a danger, the salesman should be sure the farmer knows of it. If the property requires posting, as for applications of more than one pound of parathion, methyl parathion, or EPN per acre, he should be sure this requirement is known. More than 200 citrus pickers have been affected by residues of parathion and other organic phosphorus compounds this year in California.

Will remnants of the pesticide present any hazard to crops, workmen, children, or livestock? If the material has any particular hazards, the salesman would do well to see that the farmer is aware of the danger and has not stored any remaining material where it might cause serious trouble later on. Storage of 2,4-D near seeds or fertilizer can cause heavy losses. Storage of remnants of sodium arsenite solution or parathion can cause injury or death several years later when children reach the material.

The Crop

Will application at this time impart excessive residue on the crop at harvest time. This problem is being partially solved by formalized pre-harvest intervals established for many pesticides on many crops. It should be realized that in most cases, these intervals have been whittled to the minimum for competitive purposes. Any further reduction may lead to trouble. A salesman should make sure the farmer understands what pre-harvest interval is needed for the pesticide he is using.

Is the proposed treatment acceptable to any processor or canner involved? A salesman may be in trouble if an application is contrary to conditions established by the processor or other prospective buyer of the crop. Late application of sulfur to tomatoes, for example, might be objectionable to canners.

Does the formulation contain any component that might be in-

jurious in this application? Damages have been paid where salesmen forgot that the particular crop or variety was susceptible to injury by the pesticide he sold. Sometimes he has overlooked the fact that the sulfur diluent in the dust was distinctly injurious to certain melons, or the petroleum oil or solvent it contained spotted the bloom on plums, disfigured the petals on commercial flowers, or damaged the crop in some other way.

Will use of this material present any hazard to crops subsequently grown in the field? Application of benzene hexachloride to a crop can affect other crops grown on the field several years later. Off-flavor of potatoes from some areas has been attributed to the residue of BHC applied to previous cotton crops. Excessive applications of DDT and other persistent chemicals can build up detrimental residues in the soil that will affect growth of subsequent crops.

Miscellaneous Hazards

Will this application affect fish in the treated areas or in areas where irrigation water may drain? One of the biggest storm of complaints in recent years followed wide-scale application of dieldrin to rice which contaminated drainage water and killed spectacular numbers of fish.

Will this application present any hazard to wildlife? Improper use of pesticides can kill wildfowl, deer, or other wildlife.

What effect will the application have on the beneficial predator and parasite insects? Beneficial insects might be an important consideration that should not be overlooked. Sometimes the role they are playing requires selection of a different pesticide or of a dosage or timing different from one that would otherwise be used.

Will application contaminate irrigation or drainage water and injure other plantings or animals? Transporation of insecticides and herbicides by water has resulted in damage to other crops and to livestock.

Are empty containers going to be disposed of in a proper manner? Failure to dispose of emptied containers can cause serious damage, injury, and even death. Leaving full or emptied containers unattended where they present a hazard may lead to criminal complaint against the responsibile persons. A careful salesman will properly advise farmers and operators about proper disposal. Cans and glass containers should be crushed and buried. Usually paper containers should be promptly burned, while avoiding the smoke, but burning 2,4-D containers can cause widespread damage. The salesman should recommend what is proper for each material he sells.

Will this material cause a contamination problem in the application equipment? Many damage suits have been based on contaminated equipment, particularly involving 2,4-D.

Suppose a pesticide salesman has carefully considered each one of these questions and secured the full cooperation of the farmer and the operator to make certain that no complaint arises from any of these causes. Perhaps one might think he could rest easy and confident that he had done a good job and fully met his responsibilities. But not so! In fact some of the most perplexing and the most costly of objections raised about applications in recent seasons have come from someone not even mentioned yet—the neighbors.

No application of a pesticide should be made until adequate consideration has been given to the surrounding area and the possible hazards that might be presented there. Some of the types of trouble commonly encountered may be illustrated by the following questions:

Is this application apt to annoy nearby people because of noise, odor, dust or spray? A noisy airplane operating near a subdivision at daybreak on a Sunday morning can result in a deluge of complaints and demands for restrictive legislation. When vapors of a soil fumigant escaped during the night into neighboring homes, alarmed residents called the sheriff's office, fire department, county health department, air pollution office, and the chemical warfare section of a nearby Marine Base.

Is this application apt to scare livestock or poultry on nearby property? Regardless of the chemical nature of the pesticide involved, noisy, spectacular operations, such as application by aircraft, can frighten horses into seriously hurting themselves on fences, cause turkeys to break their legs and wings, cause dairy cattle to drop in milk production, and cause hens to stop laying.

Will possible drift of this pesticide present a hazard to children, workmen, or other people on neighboring properties? Allowing a dust or spray, particularly of an injurious material, to drift onto children in a schoolyard, to a utility crew working in a neighboring field, or to a housewife hanging up her washing may be inexcusable and sometimes warrants criminal as well as civil action. When sprays or dusts have been carelessly allowed to drift across highways and into passing cars, frightened and indignant people have written to the Governor demanding corrective action.

Will possible drift of this pesticide present any direct hazard to livestock or neighboring properties? Drift of TEPP dust has promptly felled cattle on a field next to the one being treated. Chloropicrin used as a soil fumigant escaped from the treated field and collected in neighboring, low-lying property, where it drove out residents and killed a number of chickens. Drift of dusts and sprays

into herds of cattle or into barns has been charged with causing loss of milk, loss of weight, and abortion of calves.

Will possible drift of this pesticide present any hazard to honeybees on neighboring fields? Even though bees are not working in the treated field, severe losses may occur if the pesticide drifts onto neighboring hives or crops, or even onto neighboring weeds in bloom.

Will possible drift of this pesticide cause economic losses of beneficial insects on neighboring crop plants? If a citrus grower is paying to liberate predator or parasite insects on his trees, he can be understandably concerned if they are wiped out by drift of parathion from neighboring tomato fields.

Will possible drift of this pesticide injure neighboring crop plants? Drift of dusts containing sulfur has been charged with serious damage to cantaloupes. Drift of weedkillers and defoliants has caused obvious injury to trees and other plants. Drift of toxaphene and other pesticides has killed fish and frogs in commercial ponds. Fumes of volatile 2,4-D hormone sprays have drifted from treated citrus groves into neighboring tomato fields and affected the fruit. As in the next question we will consider, sometimes the nature and condition of neighboring crops will dictate choice of a pesticide or timing of an application. For example, a tomato field infested with russet mite was surrounded by fields of cantaloupes. The customary sulfur dust could not be used because of the danger of drift onto the cantaloupes, which are sensitive to sulfur. In this case, the tomatoes were satisfactorily treated with parathion. It seems paradoxical, but there are circumstances such as this one when parathion is safer than sulfur. Each case must be considered separately.

Will possible drift of the pesticide impart any detrimental residue on neighboring crops? This question has been saved for the last, because it is the one that has been of most concern to everyone during recent months. The hazard is particularly acute if the neighboring crop is close to harvest, if the pesticide is a persistent one, or if the pesticide has no tolerance or a zero tolerance on the neighboring crop. Drift of DDT, toxaphene, or a similar pesticide onto hay or pasture can be economically disastrous. It might render the hay or forage unfit for sale and, even more costly, if the contaminated material is inadvertently fed to dairy cows, it might cause condemnation of all the milk from a dairy herd for a prolonged time. Mere traces of DDT, for example, on feed are concentrated in milk and no measureable residue of any pesticide is permitted in milk. Tests have shown that it is possible to apply a spray to a crop without permitting any drift across one fence line if it is done carefully, using the right equipment and the right formulation under the right weather conditions and during the right airflow. However, the slightest error can cause significant drift and contamination. Selection of a suitable pesticide in a given instance should be made only after the probability of drift and its consequent hazard has been fully assessed. Sometimes proximity of another crop requires selection of another and less effective pesticide that would otherwise be used, to avoid the very serious hazard of drift.

Looking back on these questions, it seems obvious that no one can expect the pesticide salesman to make certain that all these problems have been solved adequately in every application of the pesticides he sells. It seems natural to expect that the farmer will be aware of some of them and take care of them, and that the pest control operator will be aware of others and take care of those. However, a salesman cannot safely assume that the farmer or the pest control operator are fully aware of all the characteristics or hazard inherent in the pesticide he sells. It is his responsibility to make certain that they do know. Unless he examines the crop and property to be treated, and the surrounding crops and properties, and carefully evaluates not only the treatment he recommends but the probability of trouble arising from the application, and properly informs the others, he may be surprised to find how complex and how extensive are the responsibilities of a pesticide salesman.★★

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Ruelene Shows Promise

Promising results with Ruelene, a new chemical for the control of cattle grubs, have been reported by the Dow Chemical Co., Midland, Mich. The material already is known to be effective for the control of various intestinal parasites of cattle, sheep and swine.

Best results with Ruelene were reported from spray and feed applications showed an 82 per cent reduction in cattle grub infestations.

Still undergoing field tests, the product will not be available on the market this season, according to Dow.

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Chloracetic Acid Pesticides

In the course of screening a number of compounds as insecticides and miticides, several factors of chloracetic acid showed some activity against selected species. To find more effective compounds, and also to determine any chemical structure relationships to toxicity, a large series of these esters were prepared and tested against five species of arthropods.

Ninety-eight esters were synthesized in the laboratory, and tested against the southern armyworm, salt marsh caterpillar, boll weevil, two-spotted spider mite and cotton aphid. The most toxic of the compounds tested was (2-cyclohexyl-4, 6-dinitro) phenyl chloroacetate, which was effective against all the test species except the boll weevil. The 2-bromoethyl and 1,2-propanediol esters were effective against the southern armyworm.

Complete data on this investigation appears in USDA bulletin ARS-33-50, April, 1959.

Some Aspects of Change in FERTILIZER PROCESSING, CONSUMPTION, MARKETING

by Vincent Sauchelli
National Plant Food Institute
Washington, D. C.

RESEARCH and development leading to technical innovations have characterized American agriculture and the fertilizer industry in the past two decades no less than other parts of the economy. Research in agriculture has received generous funds from federal, state and private sources and the results have benefitted the entire national economy. The fertilizer industry has responded to these research forces in agriculture with improvements in its technology and its products. These changes are discussed below.

Factors of Change

The factors and major influences of change which have been effective in increasing fertilizer production and consumption since World War II may be listed as follows:

Shortage of farm labor, sharp rise in farm labor wages, greater use of powered machine equipment, inexorable weeding out of inefficient farmers, larger farm units to permit economic use of powered equipment, lower cost of plant food relative to other factors of production, better promotional efforts to convince wavering farmers that fertilizers are the indispensable modern tool for reducing crop unit cost of production and a high return on the fertilizer investment dollar.

Now let's take a quick look to see what changes took place.

During the period 1947 to 1957 (ending June 30) the consumption of all plant nutrients almost doubled. Dollar sales of fertilizers during this decade increased by about 2.6 times. In this same period, nitrogen sales showed the highest increase among the three major plant nutrients, with a growth factor of about 2.8 as compared with a factor of 2.4 for potash and 1.5 for phosphate. The percentage change in consumption of plant nutrients during this decade in this country is summarized in the following tabulation (1):

	Percent
Consumption of total primary nutrients	+ 95
Consumption of:	
Nitrogen	+185
Phosphates	+ 60
Potash	+130
Average analysis of all fertilizers consumed	+ 45

Not all regions of the country experienced increases of these magnitudes. The greatest increases were made in the West North Central Region, and they were these: a +394% increase in the consumption of total nutrients; +1591% for nitrogen; +264% for phosphates; +467% for potash; and +64% in the average analysis of all fertilizers.

(1) Source: Baum, E. L. & Clement, S. L. *Commercial Fertilizer*, Oct. 1958, p.48.

New Concept of Fertilizer Use

Fertilizers are only too often promoted on the basis that they are an aid to maintain or increase soil fertility. A true concept in present day agriculture seems to be that the important function of fertilizers is to raise the level of soil fertility to a point that will allow the improved varieties of commercial crops to realize their higher yield capacities: plant breeders have developed varieties that need more plant nutrients per unit area of soil if they are to produce at the higher rate they are capable of. Hybrid corn varieties, for example, have the capacity to yield 200 to 250 bushels per acre under proper conditions of growth. Why then should farmers be satisfied with 75 to 100 bushel yields on improperly fertilized soil? The modern trend in fertilizer formulation is toward a higher concentration of total plant nutrients.

Many forecasts as to future consumption of plant nutrients have been attempted. A recent pro-

jection (2) indicates that fertilizer use will expand at a very rapid rate during the next decade or two. The following table summarizes this projection.

Actual Consumption	Amount 1000 Tons	Index (1955=100)
1950	4,058	66
1955	6,119	100
1956	6,055	99
1965 Projections		
High	7,700	126
Low	7,650	124
1975 Projections		
High	11,450	187
Low	10,050	165

(2) Ruttan, V. W., Purdue Univ., *J. Ag & Food Chem.* 6, No. 9, Sept. 1958, p. 652-56.

Changes in Fertilizer Forms

Up until very recent times, fertilizers were generally prepared in a solid, pulverized form. Now they are being sold as gases, liquids and powdered or granulated solids. This change has involved a tremendous corresponding change in manufacturing processes and facilities, in formulations, market structure and research attitudes and approaches.

Each of the major plant nutrients is characterized by its own raw material as a source from which it is extracted. Most manufacturers tend to prefer, for economic reasons, highly concentrated sources of raw materials, as well as to satisfy their new techniques of production. We shall consider now developments in each major nutrient and start with nitrogen.

Nitrogen

The nitrogen industry comprises four principal units, each supplying an important type of raw material to the fertilizer industry. These are: (1) synthetic; (2) coke-oven by-product; (3) imported nitrogen salts; (4) organic by-products. Of these, the first two are the chief sources of supply, it being estimated (3) that about 90 per cent of all fertilizer nitrogen in today's market is furnished by synthetic processes. The list of synthetic materials is impressive: anhydrous ammonia, nitrogen solutions, aqua ammonia, ammonium nitrate, urea, ammonium phosphate nitrate, ammonium nitrate-lime, ammonium sulfate. Coke-oven nitrogen is predominantly ammonium sulfate, although in the last year or so several coke-oven plants have begun to replace the manufacture of ammonium sulfate with that of diammonium phosphate. The principal imported nitrogen material is nitrate of soda from Chile, South America. Organic by-products such as dried blood, fish and meat scraps and tankage are rapidly disappearing from the fertilizer market, because of their prohibitively high cost relative to synthetic nitrogen.

The domestic synthetic nitrogen industry has made its spectacular growth since World War II. Only three major producers existed before this war and they made cyanamide, urea and ammonia liquor or solutions of nitrogen salts. In 1943, only one commercial producer offered solid ammonium nitrate (33.5% N) fertilizer grade, namely, the Hercules Powder Company of Pinole, California. By 1957, American agriculture was using upward of one million tons of solid ammonium nitrate for direct application. The number of producers of solid ammonium nitrate at present is about twenty, and their rated capacity is about 1,500,000 tons of ammonium nitrate per annum.

One of the remarkable developments in the synthetic nitrogen industry, and perhaps the one which has influenced fertilizer marketing and usage most, is that of anhydrous ammonia. Initiated in 1930, the use of anhydrous ammonia per se and its aqueous solutions has made a phenomenal growth. In 1943, the United States had 17 plants making anhydrous ammonia, which included 8 plants owned and operated by the federal government. At present there are 18 major producers of synthetic nitrogen, operating at least 60 plants having an estimated capacity of over 4,000,000 tons of nitrogen per annum. This is a 10-fold increase in production since 1940 and a 5-fold increase since 1943. Not only in productive capacity has the nitrogen industry expanded, but also in the number and variety of its producers for fertilizer purposes. Nitrogen solutions comprising ammonia, ammonium nitrate and urea in various ratios and combinations are utilized extensively by the manufacturers of compound fertilizers. Also becoming available to the fertilizer industry are nitrogen-phosphate compounds of high analysis such as diammonium phosphate, 21% N, 53% P_2O_5 and a series of mixtures, solid and liquid, of nitrogen and phosphoric acid, for use in compounding fertilizers or for direct application to the soil.

(3) Ruttan, V. W., Purdue Univ., J. Ag & Food Chem. 6, No. 9, Sept. 1958, p. 652-56.

Phosphates

The core of the fertilizer industry is the manufacture and use of phosphates. This is the oldest factor in the industry, having been established in England in 1843. Since then, it has expanded all over the world. Prior to 1930 about 200 fertilizer plants in the United States produced normal superphosphate having an average of 16-18% phosphoric anhydride, P_2O_5. Their rated annual capacity was about 1,600,000 tons of available P_2O_5, but they rarely produced at more than half their capacity. The normal grade of superphosphate was until World War II in greatest demand in all countries.

By 1930, slight interest had been aroused in concentrated or so-called triple superphosphate having 45-48% P_2O_5 content. Private industry had installed facilities for manufacturing the concentrated material, but production in 1930 was only approximately 95,000 tons, most of which was used in formulating high analysis fertilizers.

World War II created a strong demand for the products of agriculture. Many factors, chief of which was transportation costs, favored the use of high-analysis fertilizers. This created a demand for

triple superphosphate along with concentrated nitrogen and potash materials. By 1957 the triple superphosphate industry had increased its capacity to 2,200,000 tons in 15 plants having coexisting facilities for making phosphoric acid while other plants produced the triple superphosphate with purchased acid. By 1957, also, use of triple superphosphate for direct application had increased to about 225,000 tons, basis available P_2O_5. A growing demand in all regions for higher analysis fertilizers is one of the principal reasons for the increase in triple superphosphate consumption. Data as to the tonnage of triple super used in the formulation of mixed goods are not available. Total production of triple super in the fiscal year 1957 was 832,000 tons, basis P_2O_5, equivalent to 34% of the total U. S. production of superphosphates.

Production of the normal grade of superphosphate, meanwhile, has also increased. The industry has nearly doubled its capacity and production since 1930 and in 1957 produced 1,452,000 tons, basis P_2O_5, equivalent to 7,260,000 tons 20% superphosphate. The expanding market for phosphates, however, seems generally to be favoring the more concentrated forms of phosphatic fertilizers.

A parallel technological development in the nitrogen and phosphate industries accounts for the appearance of new ammonium-phosphatic compounds such as 16-20-0, 11-48-0, 21-53-0. By 1957 approximately 400,000 tons of these materials were used annually for direct application to the soil. The 21-53-0 being entirely water-soluble will become increasingly important not only as a direct application material but also for use in liquid mixed fertilizers.

Another important development in the phosphate field is the production and use of liquid phosphoric acid (both wet process and furnace process) as a direct application material, particularly in irrigation water and in the production of liquid mixed fertilizers. Between 1949, when its total consumption was about 6,000 tons and market chiefly in California, and 1957, consumption of liquid phosphoric acid had increased 3-fold. If production in commercial quantities continues, it will find ready acceptance among many fertilizer manufacturers for formulating mixed goods of high analysis. Another innovation of great promise is the so-called superphosphate acid, containing 76% P_2O_5 equivalent, but which is not as yet produced commercially (4) in the United States.

Potash

The American potash industry is relatively young, having begun its existence with the opening of deposits in New Mexico in 1931. Prior to that time American farmers were dependent upon imports chiefly from Germany. By 1941 our American industry was capable of furnishing the country's complete requirements in potash. Changes in technology in this industry have been made primarily in mining techniques and methods of processing and refining the crude ore. The number of companies in this industry is few: 7 plants in 1939 of which four were of major size; in 1953, 10 plants producing about 2,000,000 tons of potash, K_2O equivalent or about a 7-fold increase since 1939. Potash consumption in recent years has increased almost as rapidly as nitrogen. The mining and processing of potash requires a heavy capital investment which perhaps accounts for the relatively few companies engaging in this industry. Considerable interest is at present being generated among producers by the development of a potash industry in neighboring Canada.

Mixing Industry

The most significant technological innovation in the fertilizer mixing industry next to granulation is perhaps the TVA continuous ammoniator. Fertilizers in this country are used chiefly in the form of mixtures of nitrogen, phosphate and potash materials, in various ratios. An important development in this industry is the use of aqueous ammonia or nitrogen solutions for ammoniating the superphosphate in the mixture. These replace solid nitrogen materials. The continuous ammoniator made it possible for many of the smaller plants to utilize the lower-cost forms of nitrogen represented by the solutions. It also permits continuous rather than batch operation, resulting in greater efficiency and lower costs.

New Marketing Patterns

Important changes in marketing patterns are appearing in many sections of the country, and particularly in the Middle West associated with the distribution of solid and liquid fertilizers. It is too soon to know what the impact of these innovations may be on the established patterns.

The NPFI Program

Believing that the potential for expansion of fertilizer consumption remains large and attractive, the National Plant Food Institute inaugurated last year a planned campaign to increase industry-wide research, educational and promotional programs. The plan involves grants of funds to universities and colleges to strengthen research in fertilizer use, farm demonstrations in cooperation with state and federal agencies, and the use of soil testing as a basis for fertilizer recommendations. To implement this expanded program the first step was to establish regional offices in order to localize its efforts to the greatest extent possible. It is only within the past decade that farmers in many of the regions of the country have awakened to the profit opportunities that can be realized by the proper use of fertilizers in their cropping programs. The remarkable increase in demand for fertilizers in the Corn Belt, for example,

(*Continued on Page* 118)

(4) Striplen, M. M., Jr., et al. *J. Agr. Food Chem.*, 6, No. 4, Apr. 1958, p. 298-303.

for less than $5000.00

A Quality Control Laboratory in Every Fertilizer Plant.

EVERYONE in the fertilizer industry over recent years has observed and agreed that modern fertilizer manufacture is an advanced science, requiring the services of technically trained personnel, and technical services, yet all too few of the smaller fertilizer manufacturers maintain control laboratories. Several factors emphasizing the need for routine chemical controls are: the continuing advances in fertilizer technology;—demand for improved and high-nutrient fertilizers; -and the entry of state and federal government into the picture, controlling and policing product guarantees.

To be sure the final product meets specifications, many fertilizer producers have engaged consulting laboratories to provide control data. Obviously such a system is critically hampered by delays involved in getting the needed analyses. A fertilizer plant can hardly stop manufacturing while the sample is sent to the laboratory, analyzed and returned—the whole routine taking in some cases as long as five days to three weeks. So, while continuing operations, some small producers, to avoid deficiencies in the product, and the consequent fines, are putting in more nutrient than needed, with no ex-

Photo above, at left: the Phosphate Determination Equipment, and Titrating flasks.

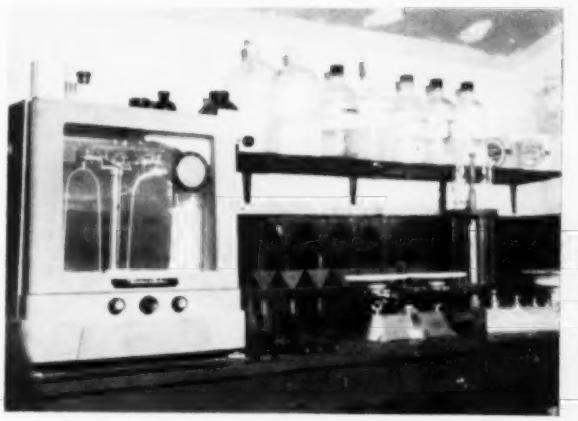
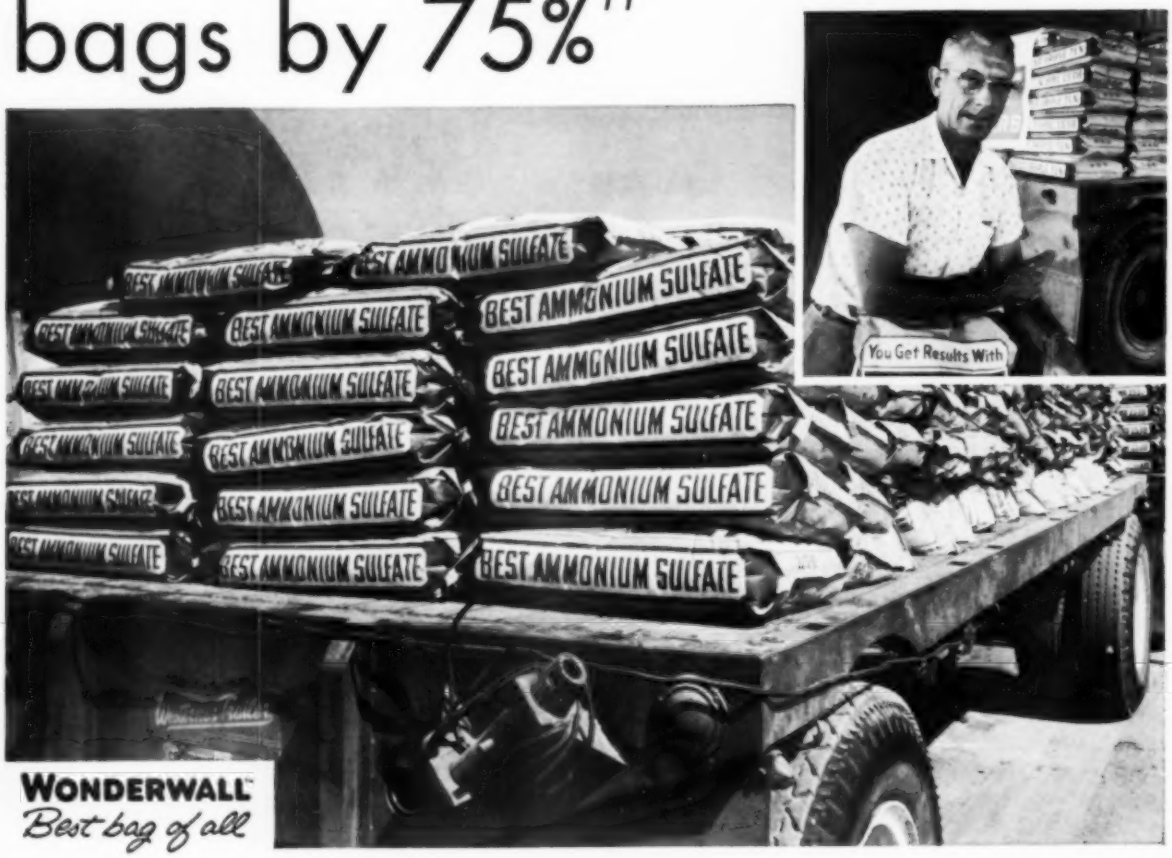


Photo at the right: Weighing and filtering section of control laboratory.

Photo at the right: Nitrogen determination equipment.

"WONDERWALL™ reduced our losses from damaged bags by 75%"



"Losses caused by damaged bags have been reduced by at least 75% since we started shipping our twelve different formulas of ammonia phosphate and sulfate fertilizers in WONDERWALL bags," says Mr. Alfred G. Roecks, assistant plant manager at the Best Fertilizers Company, Lathrop, California.

The Best Company packs 80# of fertilizer in a sewn valve bag, 15" x 4½" x 32½". The old 4-ply natural kraft bag they used was 1/40, 2/50, 1/60, totaling 200# basis weight. The 3-ply WONDERWALL bag they are now using is 2/50, 1/70, totaling 170#. These bags—15% lighter—have proved to be *stronger* than their previous 4-ply bags!

WONDERWALL is West Virginia's new, tougher multiwall that outperforms ordinary bags because it's made of Kraftsman Clupak* paper. This extraordinary paper stretches and withstands punishment that breaks ordinary kraft. Best now plans to use bags made from Clupak extensible paper exclusively.

Besides obtaining reduced breakage, many companies packing fertilizers, feed, cement, chemicals and similar products are also achieving substantial *bag cost savings* through use of the lighter, tougher WONDERWALL bags.

Let a West Virginia representative show you how *you* can cut bag costs and reduce breakage. Write or call Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, New York.

**Clupak, Inc.'s trademark for extensible paper, manufactured under its authority.*

West Virginia Pulp and Paper

tra credit but at substantially higher cost. Large fertilizer manufacturers, of course, have their own laboratories . . . the small manufacturer (that is one who produces anywhere from 25,000 to 50,000 tons of mixed fertilizer a year) faces a quality control problem.

The advantages of a low-cost control laboratory in the fertilizer plant scene are obvious and do not need to be elaborated. Complete analysis can be obtained in a matter of four to five hours, with individual determinations in less than two hours. Any adjustment in raw materials or operating procedure can be made in time to save money and avoid trouble. The question therefore, is how low can cost be?—and will expensive technical personnel be required to run the laboratory?

C. Roy Curtis & Son, Inc. of Marion, New York, was faced with just such a situation. A recognized authority on Fertilizer Analysis was contacted and requested to design, equip and stock a laboratory to provide rapid analytical procedures for the determination of the following values in fertilizers, which may be in production or shipped:

Moisture Content (Vacuum-Oven Type Moisture)
Total Nitrogen
Total Phosphate
Insoluble Phosphate
Free Phosphoric Acid
Soluble Potash

The Consultant, working closely with the Will Corporation (laboratory equipment and chemicals suppliers) presented a detailed outline of the requirements (equipment and chemicals) for a laboratory that would be suitable for performing the services indicated.

Upon study, it was found that the cost of the equipment and sufficient chemicals to operate this laboratory for six months would be about $2500. It should be noted that the equipment list was so designed that it could be operated in a small room, and the determinations would be run in duplicate only. Electrical outlets, water connections, a sink and tables cost about $1500, bringing the total to $4000, which is a very modest investment while still offering a means of effecting tremendous savings. Many mixers are giving away anywhere from $1.00 to $2.00 worth of material in every ton they mix, to remove any doubts as to whether they might be fined by the state for not meeting the guarantee of their mix. Furthermore, by efficient use of the laboratory, a producer can take advantage of other economies—for one, taking advantage of overages which may occur in raw materials and accordingly adjusting the formulation.

A practical small laboratory proved to be possible, since methods for analyzing fertilizer are well established, and have been formulated by the Association of Official Agricultural Chemists over the years. These methods have been improved to the point where they are not too expensive to operate, and do not require the services of a chemist with a college degree. With intelligent supervision, a high school graduate can be employed to run the tests in a small laboratory.

Proceeding along these lines, the consultant rewrote the established methods of analysis in "cook book" form (set forth in a stepwise progressive procedure), including detailed instructions for making the reagent solutions required in the analytical methods. A review of the equipment selected and reagents required for each of the methods follows:

Moisture Determination

Moisture can be determined in two ways, depending on whether a quick moisture figure is desired—that is one which might include some of the water of crystallization present in some of the chemical salts—which is readily removable at low temperatures; or true free water determination.

In the first case, samples are placed for three to five hours in a 110-volt electric oven, and the calculation based on difference in weight.

For a true moisture determination, a vacuum desiccator method is suggested, in which a 20-28-inch vacuum is maintained in the desiccator, for a period of 12 to 18 hours. The difference in weight is a true free-water value. In this analysis, it is necessary to have a 110-volt vacuum pump. Also required is a second desiccator (made of aluminum) for cooling the oven-dryed moisture dishes, and small aluminum weighing dishes, to handle 2-gram samples.

Nitrogen Determination

The determination of nitrogen by the Reduced Iron Method requires the use of a Kjeldahl digestion rack, consisting of two 110-volt units. Also required is a two-unit distillation flask, since the method calls for distilling converted ammonia into a flask after digestion. Fumes arising from the digestion flask are condensed by water and removed; the distillation unit uses water to condense the steam that is liberated and helps to carry the ammonia over to the final flask. In addition, the necessary flasks, connection bulbs and Erlenmeyer flasks for collection the distillate, plus rubber tubing and stoppers should, of course, be supplied to complete the supplies required in this analysis.

Total Phosphate Determination

Using the official A.O.A.C. method, the sample is digested in aqua regia on a electric hot plate. After this digestion, the solution is transferred to a volumetric flask, filtered, and an aliquot taken for precipitation of the phosphate, which is determined by the use of ammonium molybdate. The only equipment required, therefore, are the usual flask, pipettes and funnels (both gravity and suction)—the major unit being an electric hot plate.

(*Continued on Page* 115)

DDT Grinding in

Photo above:

Left: Production scale Sturtevant Micronizer fluid energy mill,—basis of the formulating plant at Alwaye, South India.

Top right: Sturtevant fine-grinding laboratory at Dorchester, Mass., where preliminary tests on indigenous Indian materials were made.

Bottom right: Cast DDT aging, prior to formulation.

THE government of India, still confronted with a great need for insecticides, primarily for malarial and filarial control, felt it desirable to expand total production of DDT beyond the two-tons a day produced at its New Delhi plant, which had been built earlier this decade in conjunction with UNICEF and WHO (World Health Organization).

In 1956, the Indian government contracted Singmaster & Breyer Inc., New York, to install on a turnkey basis a DDT plant having a daily capacity of four long tons. The facility, to be operated by Hindustan Insecticides Private Ltd., which also operates the New Delhi plant, was to incorporate a modern, efficient formulating plant. Upon its completion, India looked forward to supplying over 60% of its internal DDT needs. (This conjecture proved correct.)

One of the basic problems in connection with the formulating plant was the necessity of utilizing a maximum amount of formulating materials that either could be produced indigenously or were natural to India. Experience at the New Delhi plant had emphasized the importance of this aspect.

Certain types of indigenous clay were sent to the United States for experiment before equipment could be specified. Sturtevant Mill Company, Dorchester, Mass. participated in this line of investigation. Tests on Indian inert materials were made on the Micronizer fluid energy grinding mill, with very promising results. Subsequently Sturtevant was sub-contracted to engineer and fabricate the formulating plant equipment on September 6, 1957.

The formulating plant was installed and ready for operational tests on March 6, 1958 — only six

months to the day from the contract signing. This total time lapse includes time for final engineering, procurement of equipment, its despatch to South India, and the successful completion of both the DDT plant and the formulating unit. It was through the close cooperation of Sturtevant that formulating equipment was ready in time, and, in India, our work was made easier through the exceptional cooperation and guidance of S. S. Jaggia, managing director of Hindustan Industries, and one of India's outstanding personalities in the field of industrial progress.

Formulating Process

The first operation in DDT formulation is the grinding of

India

Singmaster & Breyer, Inc.
New York

large cast slabs of unadulterated DDT, or the grinding of pure DDT, which has a very high set point (90°C.), and is a sticky and tacky material (tending to agglomerate or melt under grinding pressures and temperatures. Aging permits further crystal growth and the consolidation of impurities at crystal interstices, thus alleviating these problems to some extent. However, despite the difficulties of grinding "green" DDT, the primary grinding mill, in conjunction with its conveyor belt and shroud, does successfully grind DDT materials which have been aged about two days. From this preliminary grinding, the technical-grade DDT is fed into the boot of an elevator and, with the necessary diluent and detergents, is further fed into a ribbon blender for thorough dispersing. From the blender, it is conveyed through a rotary mechanical valve to a grinder, where lumps are broken and further dispersement of this diluent material is effected. A hopper then receives the material and in turn, screw-feeds it into the extremely high velocity rotating air stream of the Sturtevant Micronizer, where the interaction of the particles themselves accomplishes the final grinding.

The Micronizer works on the principle of super-speed rotation of particles produced by tangential jets of compressed air, which causes violent interactive impact of the particles, resulting in fine pulverization without attritional heat. Material to be fine-ground is introduced through an opening near the periphery. Adjustment of the feed rate and/or volume or pressure of the grinding fluid maintains product uniformity in the desired size range. While fines are collected and classified in the center of the grinding chamber, centrifugal force created by the high speed jets tends to keep coarser particles in the grinding zone until they are sufficiently reduced to move inward to the point of discharge.

The material is discharged continuously from the jet mill and is carried by the exhaust air stream through a large reinforced rubber hose, which discharges into a combined cylone and self-cleaning bag-type collector. From the cyclone, the material is discharged through a motorized rotary valve to a gyro sifter, and then to a rotary blender and a final drum filler. The drums are positioned on a pneumatic jolter. The entire system is operated under negative pressure accomplished by a large suction blower, and all dust discharges into the cyclone and bag. The cyclone unit has been extremely efficient in that there is absolutely no formulated material in the air discharge. This means that it is a completely dustless operation, a major concern in DDT formulating plants.

Formulating Technique

The formulation of wettable powders has been proved over the years to be more an art than a science, and in a number of instances, months of trial and error in technique and formulation are necessary before success is attained. It seems worthy of note that through the joint efforts of Singmaster & Breyer, Sturtevant, and Hindustan Insecticides, the plant at Alwaye produced—on its second test run—50% wettable powder formulated DDT entirely acceptable to WHO and the Indian Standards Institute.

The formula adopted for the 50% formulation was based almost entirely on a local china clay as the diluent. Only 5% was synthetic diluent. The actual formula used:

50% Formulation	
DDT	50%
China Clay (India)	40%
Microcel	5%
Polyfon	2.5%
Fenofon	2.5%
	100%

Further tests on this 50% formulation continue. These figures are those of the second test run,—continued testing is expected to result in a further reduction in imported materials.

A 75% formulation was as satisfactory as the 50% material, in that it, too, produced an acceptable product on the second formulation. The formula adopted for that run and still being used at Alwaye is:

75% Formulation	
DDT	75%
Microcel	15%
Polyfon	2.50%
Fenofon	2.25%
China Clay (India)	5.25%
	100%

India's desire to increase DDT capacity has been realized by the new Alwaye Plant. We consider such an outstanding performance reflects largely on the selection and design of the equipment incorporated into the plants and the intercooperation of the companies concerned.★★

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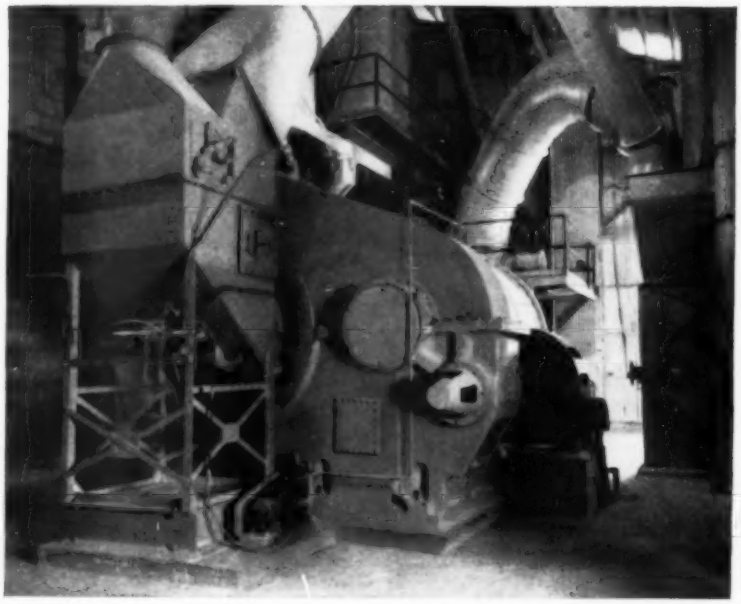

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New Pesticide Review Attracts 500 Salesmen, Applicators, Growers,

MORE than 550 pesticide salesmen, farmers and farm managers attended a conference on "New Pesticides Review for Central California" at Fresno Fairgrounds, September 10, sponsored by the Western Agricultural Chemicals Association. Industry and government experts offered the most recent authoritative information on new pesticides,—their practical application, limitations, etc.

W. A. Harvey, University of California, reported on several new herbicides, discussing the Niagara foliage contact selectives, Karsil, Dicryl and Solan; the new foliage selective marketed by both ACP and Chipman Chemicals, 2,4-DB; and the soil-applied selective herbicides, Randox, Vegadex, and Eptam. Mr. Harvey urged that manufacturers and users of herbicides make an effort to know something of the behavior of these materials so their action might be predicted under given conditions. He discussed a basic outline of herbicides classifying them into selective and non-selective materials, and reviewing their mode of action. (A full discussion of Mr. Harvey's report will appear in the November issue of *Agricultural Chemicals).*

Other reports covered such topics as: Nematodes and salad crops; tomatoes, beans and melons; grapes; cotton; citrus; stone fruits; potatoes and seed alfalfa; etc.

Particular interest was expressed in a talk by R. Z. Rollins, chief, Bureau of Chemistry, California Department of Agriculture, on "Responsibilities of a Pesticide Salesman." The full text of Mr. Rollins comments appears on pages 42-46 of this issue. A discussion on "Air Application of Pesticides" by H. C. Moore, Tulare, Calif., emphasized the need for applicators to be familiar with the hazards of pesticides; and a report by John E. Swift, Univ. of California, concerned Practical Field Aids.

Earl Butz to Address Pesticide Manufacturers at NAC Meeting

DR. Earl L. Butz will address the 26th annual conference of the National Agricultural Chemicals Association to be held October 21-23 at the French Lick-Sheraton Hotel, French Lick, Indiana. Dr. Butz is dean of the school of agriculture at Purdue University, and a former assistant secretary of the Department of Agriculture.

Other highlights of the 3-day meeting will be reports on sale, marketing and promotion of pesticides, a panel on wildlife, a review of how H.R. 6436 affects the industry, and a summary of world pest control developments. Complete program details are listed below:

Wednesday, October 21

(General Committee Chairman, Roger Roth, Velsicol Chemical Corp.)

PRESIDENTIAL ADDRESS
Jack V. Vernon, Food Machinery & Chemical Corp.

SALE AND MARKETING OF PESTICIDES
Robert S. Thompson, Thompson-Hayward Chemical Co.

ADVERTISING AND PROMOTION OF PESTICIDES
L. F. Czufin, California Spray Chemical Corp., Richmond, Calif.

PANEL ON WILDLIFE
Moderator: J. Dreessen, NAC
W. W. Dykstra, Fish & Wildlife Service, USDA,
Clarence H. Hoffman, USDA
Charles Lincoln, University of Arkansas
Charles H. Callison, National Wildlife Federation

Thursday, October 22

COMMITTEE MEETINGS

Friday, October 23

(Presiding: Charles H. Sommer, Monsanto Chemical Co.)

INTRODUCTION OF NEWLY ELECTED NAC PRESIDENT

NAC WORKS FOR THE INDUSTRY
Legislative—L. G. Gemmell, Geigy Agricultural Chemicals
Public Relations—A. Northwood, Jr., Shell Chemical Corp.
Traffic—G. W. Wilson, Rohm & Haas Co.
Lawyers—G. T. Scriba, Union Carbide Chemicals Co.
Technical Advisory—R. Barron, American Cyanamid Co.

WORLD PEST CONTROL DEVELOPMENTS
Dr. Charles Palm, Cornell University

H.R. 6436—HOW IT AFFECTS THE INDUSTRY
J. A. Noone, NAC Association
Justus Ward, USDA

Insect Resistance Symposium October 7 & 8 In Washington

ROBERT L. Metcalf, University of California, Riverside, will be chairman of the symposium on the progress of research into insect resistance being held October 7 and 8 at the Mayflower Hotel in Washington, D. C. The symposium is jointly sponsored by a committee of the National Agricultural Chemicals Association and the Entomological Society of America.

The symposium will be divided into three major segments that will cover the current status of resistance, fundamental knowledge now available about insect resistance to insecticides, and views on future research. Dr. Metcalf will open the two days of talks with a statement of the symposium's objectives and will close the proceedings with a summary of the facts and recommendations presented during the symposium.

Among the speakers will be Floyd F. Smith, USDA, Beltsville, Md., who will discuss the resistance of greenhouse mites to acaricides; and L. R. Jepson, University of California, Riverside, who will cover the resistance of mites attacking citrus.

Also discussing the resistance problem as it pertains to various agricultural pests will be: E. H. Glass, New York Agricultural Experiment Station, Geneva, insects attacking orchard crops; R. K. Chapman, University of Wisconsin, Madison, insects attacking vegetable crops; H. G. Johnson, National Cotton Council, Memphis, Tenn., and J. S. Roussel, Louisiana State University, Baton Rouge, La., cotton insects and mites; and W. C. McDuffie, USDA, Kerrville, Texas, pests of livestock.

Robert L. Metcalf

A Canadian zoologist, Dr. A. W. A. Brown, head of the Department of Zoology, University of Western Ontario, London, Ontario, will discuss the resistance problem in the World Health Organization programs for vector control.

The formal genetics of resistant strains of insects will be outlined by J. Crow, University of Wisconsin, in the sessions covering fundamental knowledge about resistance. Speaking on like topics will be R. Milani, University of Pavia, Italy, who will discuss genetical studies of resistant insects; and W. M. Hoskins, University of California, Berkeley, who will present the dosage-mortality curve as an indicator of resistance to insecticides.

The need for quantitative measurement of level and extent of insecticide resistance in field populations will be covered by K. D. Quarterman, U. S. Public Health Service, Savannah, Ga., and H. T. Reynolds, University of California, Riverside. Mr. Quarterman will outline test methods for establishing levels of susceptibility and detecting the development of insects of public health importance. Mr. Reynolds will stress the urgency and importance of establishing standard detection methods and levels of resistance in agricultural insect pests.

The biochemical aspects of resistance are to be covered by C. W. Kearns, University of Illinois, Urbana. A. S. Perry of the U. S. Public Health Service, Savannah, will discuss biochemical aspects of resistance to chlorinated hydrocarbon insecticides, and R. B. March, University of California, Riverside, is to discuss the biochemistry of resistance to organophosphorus insecticides.

Selective insect control and its application to the resistance problem is the topic of a paper to be presented by Walter Ripper, Dow Agrichemicals, England. In a luncheon address on Oct. 8, Dr. William P. Boger, Director of Research, Norristown State Hospital, Norristown, Pa., will tell of antibiotic resistance problems that are occurring in man.

E. F. Knipling, USDA, Beltsville, will present views on future research contributions to a solution of the resistance problem, and George R. Ferguson, Geigy Agricultural Chemicals, Ardsley, N. Y., will discuss future pesticide research. J. E. Johnson, Dow Chemical Co., Midland, Mich., will sum up the resistance problem from the veiwpoint of a member of the chemical industry.

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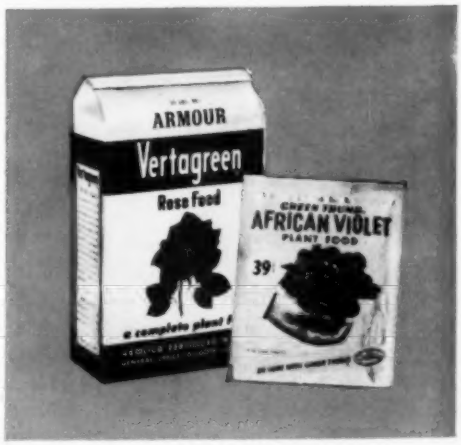

WASHINGTON REPORT

By Donald Lerch

THE pesticide chemical business, which has been climbing at a healthy rate, is in for a boom in the next five years, in the opinion of John A. Field, vice president for marketing of the Union Carbide Corporation. Mr. Field points out that merely to maintain the expansion rate projected for it, the organic chemical industry will have to grow as much in the next five years as it has so far during its entire lifetime.

This is good news for pesticide industry leaders now preparing to attend the National Agricultural Chemicals Association's 26th Annual Meeting in French Lick, Indiana, October 21-23. The meeting will feature discussions of the major issues facing the industry in a period of almost explosion-like expansion. Advertising, promotion, sales and marketing are to be topics which several speakers will discuss.

A surprise entertainment feature at NAC's 25th Annual Banquet, October 22, will be a man whose calling card reads: "Have Bunny, Will Travel." The man is Don C. Anderson, of Allied Chemical Corporation's General Chemical Division, who has turned his talent at magic, into a powerful sales tool. His scheduled banquet performance is billed as "Chemical Magic For Today."

Other late NAC program notes: It is understood that Dr. Charles E. Palm, Dean, College of Agriculture, Cornell University, will speak on Friday, October 23, on World Pest Control Developments. Dr. Herbert L. Haller, Assistant to Administrator of USDA's Agricultural Research Service, originally scheduled to address the meeting at this time, will be on official business in Europe.

* * * * *

In coming months you're going to see more activity by the U. S. Food and Drug Administration in a variety of fields affecting pesticides and chemical additives. This is the conclusion to be drawn from the 26.4% increase in Congressional appropriations to the Food and Drug Administration for fiscal 1960. In dollar terms, FDA will have $2,883,000 more for its operations in the year July 1, 1959 to June 30, 1960 than it had in the previous year.

A breakdown of the appropriation shows where the money will go and where you can expect activity to grow. $480,800 for the administration of the Food Additives Amendment passed last year will permit increased staff for reviewing safety data, setting safe tolerances, and inspecting factories and samples of food additives.

A total of $670,200 is for research on health problems, including research into new methods for identifying and measuring pesticide residues in foods. $967,800 is allocated to increase the number of inspections of food, drug and cosmetic factories from 21,840 to 27,000 a year. And $124,900 is to promote voluntary compliance with the law through positive educational programs conducted with the cooperation of regulated industries.

Altogether, FDA expects to add about 348 scientific, administrative, and field personnel during 1960 to carry out its enlarged program of research, and inspection. Significantly, the trend in FDA is toward continued expansion. The FDA budget in 1954 was $5,200,000. In 1960 it will be $13,800,000.

Pesticide manufacturers may be especially interested in FDA's $124,900 budget for promoting voluntary compliance with the law through educational programs run in cooperation with the regulated industries. This development offers expanded opportunities for the industry to promote the "Read The Label" campaign to assure that farmers will apply pesticides in the amounts directed, on the crops directed, and at the times directed in label instructions.

* * * * *

Despite a few hard moments, the Senate finally cleared the Metcalf Bill authorizing the U. S. Fish and Wildlife Service to request up to $2,565,000 annually for research on the effects of pesticides on fish and wildlife. Passage of the House version of this measure by the Senate has cleared the Bill for signature of the President.

An authorization measure, of course, carries no appropriations. It merely expresses Congressional approval for U. S. Fish and Wildlife to ask for additional pesticide research funds for fiscal 1961. Actual requests for the additional funds and details on how the funds will be used will not come up until the next session of Congress. Obviously, this delay will permit a continued effort to establish cooperative research in this field which cuts across the interests not only of the U. S. Fish and Wildlife Service, but of USDA, the U. S. Forest

Service, FDA, and the U. S. Public Health Service as well.

There are leaders in Washington who would like to see more research done on overall wildlife populations, including an amplification of present programs designed to repopulate areas with wildlife. Typical of such programs is the work of U. S. and State agencies in repopulating streams with fish prior to opening of each season. In their view, the real wildlife issue is not whether a bird or a fish is killed accidentally in the process of doing something which contributes to man's health and welfare. The real wildlife question is one of maintaining and, where feasible, of increasing fish and wildlife populations for man's and nature's benefit.

* * * * *

For many fertilizer and pesticide manufacturers the most popular day dream is one of finding a fabulous new market for their products. By all odds the largest potential new market for both fertilizers and pesticides is in forestry. Right now U. S. Forest Service Chief R. E. McArdle reports foresters and conservationists from all over the world are preparing to attend a major world forestry congress.

The World Forestry Congress —the fifth ever to be held—took place in Seattle, Washington, August 29 to September 16, 1960. All subjects were covered, — from the multiple use of forests to silviculture and forest management,—from forest protection to forestry education.

The National Plant Food Institute has just released another in its very successful farm radio news service series which is used by more than 1,200 radio stations coast to coast.

Louis Wilson, NPFI Director of Information, says that speakers on the series are J. B. Claar; USDA Federal Extension Service, speaking on "Production, Profits, and Plant Food"; Dr. Robert W. Pearson, USDA Soil & Conservation Research, speaking on "Fertilizer Goes With Irrigation"; Dr. W. H. Graham, NPFI Northeastern regional director, speaking on "Proper Fertilizer Placement A Must"; and Dr. T. S. Ronninger, USDA Agricultural Research Service, speaking on "Three Goals in Forage Crops Research."

* * * * *

A revised and improved edition of NAC's slide kit, "Pesticides —Boon To Mankind" is now being released to NAC member companies.

The slide kit tells the story of how pesticides increase our food supply, improve food sanitation, and health, and bring many other benefits. It is designed for showing to non-technical groups such as women's clubs, civic organizations and youth groups. Though not yet heavily publicized, NAC already has received more than 50 requests for the slide kit for public showings extending well into 1960.

* * * * *

USDA, always on the alert against pest epidemics, has begun a new insect early identification program which merits the attention of everyone engaged in pest control. Idea of the program is to encourage citizens to send new, unusual insects to county agents, agricultural experiment stations or entomological field workers for identification.

Noting that many of our most destructive pests come in from other countries, USDA urges the program as a way to identify insect pests early and eradicate them before they can cause serious damage.

Citizens being called upon to help in this campaign include all entomologists, farmers, 4-H'ers, foresters, millers, home gardeners, and all other citizens. Insect detection guides and information on insects not now known to be in the U. S. are to be issued.

Behind this campaign is the sobering fact that increased international travel boosts the danger that destructive foreign pests will be introduced into the U. S. This danger is greatly increased as we receive more visitors from underdeveloped countries where pest control is primitive.

Destructive insect imports include the European corn borer, the pink bollworm, gypsy moth, Japanese beetle, khapra beetle, white fringed beetle, and the imported fire ant. Imported insect pests which have been eradicated by prompt identification and vigorous action include the Mediterranean fruit fly, citrus blackfly and Hall scale.

* * * * *

From far-off Communist China comes word of possibly one of the worst insect attacks of recent history. Following in the wake of a serious drought, insects have struck at rice, cotton, and other crops in devastating numbers.

The Communist Chinese newspaper, "People's Daily," reports that in one province, Honan, 13,800,000 people have been mobilized each day to combat locusts. Besides airplanes spraying insecticide, the combatants are using hand sprayers, wind boxes, gunny sacks, flails, and bare hands.

The aim of the all-out program is to eliminate all insect pests on and above the ground. Extent of the devastation appears to go far beyond pest-caused disasters experienced in the United States prior to the development of the modern pesticide industry and modern techniques for pest control and eradication.★★

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Diazinon Crop OK's Expanded

Eighteen more fruits and vegetables have been added to the list of crops for which Diazinon insecticide has received label claims acceptance, bringing the total to 45, according to Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N. Y.

Newly-accepted is use on grapes, cantaloups, carrots, collards, cranberries, endive, kale, lima beans, muskmelons, parsley, parsnips, radishes, summer and winter squash, Swiss chard, turnip roots and tops, and watermelons. Residue tolerances of 0.75 ppm have been established on these crops.

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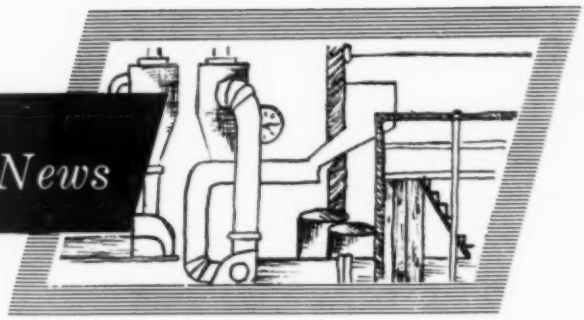
Fertilizer Views and News



Sewage Sludge For Soil Improvement

EXPERIMENTS were initiated in 1949 at the Connecticut Agricultural Experiment Station to explore further the suitability of digested sewage for soil improvement and as a fertilizer. The work was done in greenhouse pots, outdoor soil frames, and field pots.

The general procedure was to apply the sludge only once, usually at several different rates, and grow successive crops on the same soil without further sludge treatment. Lime and fertilizer were applied as needed. The results are summarized as follows:

• The rate of application of digested sewage sludges should be governed more by their nitrogen content than by the amount of organic matter they contain. High applications may supply too much nitrogen.

• Sludge improves the physical condition of the soil, particularly its aggregation of particles greater than 1 mm. The improvement is readily observable in practice as well as measurable by laboratory techniques.

• Sludges differ rather widely in their properties, depending upon the character of the sewage and the kind of processing used in the treatment plant. Most sludges are acid but some are highly alkaline. The organic matter content ranges from 25 or 30 to over 60 per cent. Some come from sewage containing industrial wastes.

• All of the sludges tested contained relatively large amounts of zinc and considerable copper and boron in comparison with other common types or organic matter. Industrial wastes increase the concentration of these metals.

• In acid soils, sludge is frequently toxic to plants, the degree of toxicity varying with the type of sludge, the rate of application, the soil, and the kind of plant. The toxic effects can usually be prevented by raising the soil pH to 6 or higher.

• Of the several kinds of plants grown, spinach was most susceptible to injury, seldom showing any favorable effects from sludge treatment. Grasses and grains suffered the least from trace elements, and they usually responded to fairly heavy applications of sludge even on acid soils.

• In a greenhouse experiment, where Torrington and West Haven sludges were applied at 65, 130, and 260 cu.yds. per acre, maximum growth of oats, beans, and spinach occurred at the medium rate. Beets and turnips on the other hand, showed maximum growth at the 260 yd. rate. West Haven sludge, being lower in trace elements, produced the largest plants; but it also caused bean and spinach plants to have 1½ to 16 times as much manganese as was found in Torrington sludge-treated plants.

• In general, sewage sludge treatments delayed seed germination, particularly lettuce and radishes, although under some conditions Torrington sludge favored germination. It appears that the effect of sludge on germination is associated with the increase in total soluble-salt content, hence a similar result can come from fertilizers or manure.

• In some situations the inclusion of a moderate amount of woodchips or sawdust (25 to 30 per cent by volume) favors seed germination and plant growth as compared with sludge alone.

• Heat-dried sludges, whether raw or digested, are slow to nitrify, hence may cause temporary nitrogen deficiency similar to straw or sawdust. None of the sludges nitrify as rapidly as does commercial dried manure with which they were compared.

It is concluded, on the basis of the results obtained in these experiments, that digested sewage sludge as produced in Connecticut treatment plants improves the physical condition of the soil and has a more lastng effect than does manure.

It also supplies nitrogen and some phosphorus and trace elements. When used under proper conditions sludge improves current crop yields. High applications may delay seed germination, but they seldom lessen the final germination count.

Because the various sludges differ in reaction and in composition, it is important to know the nature of the sludge to be used. The acid sludges, especially those from sewage containing industrial wastes, may have severe adverse effects on plants. Usually such toxicity, which is due to copper or zinc, or both, and probably to iron deficiency induced by these metals, can be avoided by liming the soil to pH 6.0 or higher. Applications

(*Continued on Page* 121)

The AGRICULTURAL Applicator

- **Foliage Application of Nutrients**
- **Piper Pawnee**
- **Chemical Pruning of Citrus**
- **Versatile New Applicators**

Two versatile, high-low applicating machines are being offered to applicators of all types of agricultural chemicals. They are described on page 74. Top photo shows the Century high clearance, self propelled sprayer. At the bottom is the Gandy HiLo Granular Applicator. Both machines can do a variety of jobs

4 PM Defoliating seed alfalfa—Synox General and oil, 12 gal./acre, 50 ft. swath.

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Foliage Application Of Nutrients

by S. F. Potts

RECENTLY the interest in foliage application of nutrients has increased by leaps and bounds. Fortunately this increased interest is not confined to amateur gardeners who are more prone than the commercial farmer to try new gadgets. New vegetable growers, orchardists, and foresters are becoming interested, and many professional arborists and nurserymen are using this relatively new method of spraying nutrients to trees and shrubs and, in the main, are securing excellent results.

For some years iron salts, particularly iron sulfate and iron ammonia citrate, have been used on azaleas, pin oaks, and pineapple with leaves yellowed by iron defficiency. Citrus growers know that a zinc spray will correct a lack of zinc in citrus leaves. Spraying pineapple foliage with urea is an effective method of feeding nitrogen to pineapple plants.

The first record of the application of nutrients in the form of atomized concentrated sprays was by Potts in 1930. These formulas (Potts, 1944) were 40X concentrations of ferrous sulfate and lime (4:1), zinc sulfate and lime, manganese sulfate and manganese borate. These mixtures were applied with and without lead arsenate and calcium arsenate. In some cases a weak Bordeaux mixture was added to supply the copper. The applications were very helpful to the health and growth of trees of many plant species in the tests, particularly those belonging to the genera *Prunus* and *Amygdalus*. Many of the mixtures were rendered effective for 75 days by the tenacious residues of gelatinous precipitate formed by an interaction between the dissolved sulfates and the calcium hydroxide. Since these residues were only slightly soluble on the foliage in dew and rain, it was possible to avoid foliage injury from the heavy dosages. In some mixtures soybean oil and linseed oil were added to increase adherence. When completely soluble copper sulfate and zinc sulfate were applied, the dose had to be drastically reduced to avoid foliage injury and, in addition, three or four applications were needed during the season for maximum results.

The increase in interest in this field is due primarily to four factors, one of the more important of which is the development of the concentrated spray method of application. This method is suited to the application of nutrients. Another is the development of nitrogen-bearing compounds, such as urea, which are far less toxic to foliage than those used in the earlier days. Methods of concentrating the essential elements into safe, liquid forms are being developed.

The third reason is the discovery that many of the elements essential for good plant nutrition can enter the leaves directly. This was not believed possible a dozen years ago. Today we know that nitrogen, potassium, phosphorus, magnesium, manganese, copper, zinc, and boron can all be taken into the plant through its foliage. Future research is expected to reveal that some of the other essential elements also can enter through the leaves and be used in the plants' food manufacturing processes.

A fourth reason is the research and publicity contributed by such commercial firms as the Ra-Pid-Gro Corporation of Danville, New York, a pioneer in foliage application of a complete chemical fertilizer, and by the DuPont Company, which developed and markets urea containing 43 per cent nitrogen under the trade name "NuGreen." *Ra-Pid-Gro* is a 23-21-17 completely soluble chemical fertilizer with minor elements added. The nitrogen is obtained from crystal urea, mono ammonium phosphate and potassium nitrate; the phosphoric acid from mono ammonium phosphate and mono potassium

This article is taken from Chapter V, pages 408 to 413, of the new book, "Concentrated Spray Equipment, Mixtures and Application Methods," by Samuel F. Potts.

It is the first in a series of articles, from the pages of this authoritative work, scheduled to be reprinted in "Agricultural Chemicals" from the Potts text.

phosphate; the potassium from potassium nitrate and mono potassium phosphate.

Foliage feeding gives quick results where the problem involved is associated with nutrition. It should be borne in mind, however, that foliage feeding is not a cure-all for all plant and tree ills, nor is it a good substitute for good forest and shade tree practices. Moreover, the same ingredients in most foliage nutrient sprays now on the market will also do marvels when applied in solutions directly to the soil around trees, shrubs, flowers, vegetables, and on lawns.

The Pro's and Con's of Foliage Feeding

The points for and against foliar feeding are presented by Pirone (1952) as follows: "With three years of experience with foliage application of nutrients behind us, we would like to list the pro's and con's of the method.

The Case for Foliage Feeding

"The arguments for foliar feeding are:

"(1) Raw nutrients applied directly to the leaves become almost immediately available since they must travel a very short distance to get to the point where they are used by the plants to make plant foods.

"Consider for a moment how far these same raw nutrients must travel when applied to the soil. They must (if applied dry) first be dissolved in water. Then they must enter through the finer roots by the complicated process of basic exchange. Finally they must be transported through special tissues in the trunks and branches until they reach the leaves.

"(2) In early spring, when the soil is wet and cold, roots do not absorb nitrogen readily. With dry applications to the soil, therefore, many trees are denied this highly important element at a time when they need it most.

"(3) In midsummer dry spells, dry fertilizers in the soil cannot be used until moisture is available. Foliar sprays are immediately available.

"(4) Most of the phosphorus applied to the soil in the standard dry fertilizers is immediately fixed by chemical reactions and most of it is thus not immediately available to the tree. Hence we may have situations where one part of phosphorus applied directly to the leaves may do the work of ten or more parts applied to the soil.

"The same situation may occur with the minor elements. Zinc added to certain soils, for example, is unavailable because it is tied up in an insoluble form.

"(5) Under certain situations, as with trees planted in sidewalks or courtyards, where concrete, asphalt, paving blocks or flagstones cover their roots, foliage applications provide a rapid, inexpensive way of supplying the majority of necessary nutrients.

"(6) Foliage applications of nutrients can be made in conjunction with the regular insecticide-fungicide applications. Most of the prepared fertilizers advertised for use in foliage sprays are compatible with the newer organic fungicides and insecticides such as Fermate, DDT, and Parathion, as well as with the inorganic fungicide-insecticide, sulfur. These materials cannot safely be used with inorganics containing mercury and copper, however, because of the danger of precipitating some of the constituents of the fertilizers.

The Case Against Foliage Feeding

"(1) Foliar application of nutrients is not a complete substitute for soil applications under all conditions. In many cases it can only be a supplement to the nutrients taken in through the roots.

(*Continued on Page* 110)

Chemical Pruning Advanced

A special foliar spray, applied with more or less conventional equipment, recently enabled the Ventura Coastal Lemon Co., Ventura, Calif., to do a chemical pruning job that equalled those done by mechanized hedging and topping operations.

The spray was a 500 parts per million concentration of maleic hydrazide, a growth inhibitor that heretofore had been used largely for experimental work with ornamentals and cover crops.

The spray was applied to two groups of lemon trees in a fairly large test plot late last winter. One of the groups of trees was pruned and the other unpruned at the time spraying was done.

According to Stanley Wear of Ventura Coastal, it was impossible to detect any substantial difference in the performance of the trees during the six months following the spraying.

On the unpruned group of trees, the spray merely caused the tips of suckers to turn yellow and stop growing. It did not harm older leaves or limbs or cause fruit drop in any of the trees.

As a matter of fact, Mr. Wear said, the trees in the two test groups were among the company's better producers until August, 1959—at which time new suckers growth became abundant.

Mr. Wear said that the objective of the tests simply was to determine whether the chemical control of sucker growth is possible in the case of lemon trees. We believe we have proved that it is, he

said, but much remains to be learned before our procedure can be recommended for routine usage.

Among the factors not yet determined are: the concentrations of maleic hydrazide which are conducive to best results on various types of trees with differing ages and physical conditions; the seasons or weather conditions in which inhibitor applications might either be ineffective or harmful; and what will happen to trees where chemical pruning is continued over a long period of time.

Because of Ventura Coastal's promising results with maleic hydrazide, Mr. Wear said, Henry Heald and Charles Coggins of the University of California's Citrus Experiment Station at Riverside now are in the early stages of a carefully-controlled test program that may prove chemical pruning to be a money saving routine.

•

Liability in Pesticide Spraying

John Montgomery, association attorney for the California Agricultural Aircraft Association, has prepared a form to be signed by a chemical salesman when his chemical recommendations are contrary to those of the applicator who is to apply the chemicals.

The agreement form states that the chemical recommended will not be injurious to any crops surrounding the specific crop being treated and states that the company agrees to indemnify and to hold the farmer and any applicator employed by him free from any liability resulting from the use of the chemical.

According to the CAAA, there have been at least three separate instances recently whereby an operator lost a job because he would not take a chance and apply a dust where the adjacent crop had a zero tolerance to that dust. In the cited cases, the farmer chose to believe the chemical salesman who insisted that the dust would not hurt the adjacent crops.

Mr. Montgomery concedes that it is doubtful whether the salesman has the authority to bind the company for which he works by signing the agreement but that it should have a beneficial effect. He said that signing the agreement could force salesmen to back down on doubtful recommendations.

•

High-Visibility Finishes

New aircraft coatings, which reduce the hazards of flying through smoke and haze, are being offered by the Randolph Products Co., Carlstadt, N. J. The Vivid High-Visibility Finishes are available in orange, yellow, red, and green, and are designed for both fabric-covered and metal aircraft.

Planes coated with these finishes are said to be more easily visible in busy, haze-shrouded airways and also can be spotted more readily from control towers. Among the advantages listed by the company for flourescent coatings are easy and economical application, maximum durability, and ease of removal.

Pawnee Design Stresses Safety

THE Piper Pawnee, Model PA-25, now is in full production at the Lock Haven, Pa., plant of the Piper Aircraft Corp. and deliveries are being scheduled for one a day. The Pawnee is a low-wing, single-place airplane that incorporates a long list of features for pilot safety and maximum efficiency in the application of agricultural chemicals.

The airplane is the first model to come out of Piper's new development center at Vero Beach, Fla. Fred E. Weick, an aeronautical engineer and specialist in private and agricultural aircraft design, is director of the center.

Designed for operation from short, rough fields close to operating areas, the Pawnee's performance characteristics are said to be very much like those of the Piper PA-18A agricultural airplane, a modified Piper Cub. The Pawnee is a 150 horsepower airplane with a gross weight of 2,300 pounds, a useful load of 1,100 pounds, and a hopper capacity of 150 gallons or 20 cubic feet. The 1,200-pound empty weight includes starter, generator, battery, cockpit enclosure, and metal propeller. The Pawnee can be used for the aerial application of either liquid or dry chemicals.

Although completely new in design, many of the Pawnee's components are borrowed from other Piper models. Wings, flaps, and ailerons are derived directly from the Piper Super Cub, but increased in structural strength for a gross load of 2,300 pounds instead of 1,750 pounds. The power plant package is the same as the Piper PA-22, including 150 horsepower Lycoming engine, cowling, and motor components. The landing gear is similar to that of the Piper Pacer, using an internal Hydrasorb shock absorbing system. Tri-Pacer axles, Comanche wheels and brakes, and Apache tires are used.

Aside from these components, the Pawnee is entirely new in overall configuration and design. The fuselage, for instance, is new and is wider, deeper, and longer than that of the Super Cub.

In describing the design aspects of the Pawnee relating to safety and crash survival, Mr. Weick said that a determined effort has been made to decrease the likelihood of accidents and to protect the pilot as much as possible in the event that there is an accident.

In view of the fact that approximately half of the fatal crop-dusting accidents are the result of collisions with wires or trees, Mr. Weick said, the field of view forward and down is of extreme importance. In the PA-25, he pointed out, an unusually good view has been obtained by placing the pilot high in the fuselage. In addition, Mr. Weick continued, the low-wing arrangement enables the pilot to see where he is going in turns close to the ground.

A sharp leading edge has been provided for the landing-gear struts to help the airplane break through wires or tree branches and a cable

has been strung from the top of the cockpit to the top of the rudder to prevent the vertical tail from being snagged.

A great deal of effort obviously has been made to protect the pilot in the event of a crash. The cockpit is placed behind all heavy objects or loads in the airplane. A strong harness is provided to support the pilot in such a manner that his head will not contact any heavy or sharp objects and the cockpit, itself, is designed so that it will not collapse in a way that would injure the pilot.

An indication of the airplane's emphasis on safety is that its design conforms to all but one of the recommendations for crash survival design made by the Aviation Crash Injury Research unit of the Cornell Medical College. Among the recommendations that are carried out in the Pawnee design are: designing of aircraft structures to absorb energy by progressive collapse; locating the pilot's seat as far aft in the fuselage as possible, preferably behind the wing; designing the instrument panel to be free of sharp, rigid edges in range of the pilot's head; and designing forward fuselage and cabin structures to resist nominal crash loads, as well as flight and landing loads.

The exception taken by Piper to the research group's recommendations involves the location of the gas tank. The Cornell group recommends that fuel tanks be placed in, or on, the wings. The fuel tank of the Pawnee is located in the fuselage, between the firewall and the hopper. Mr. Weick explains that the fuselage location permits the use of a single short fuel line with simple gravity feed. Wing tanks, with the low wing arrangement of the Pawnee, he pointed out, would have required a fuel pump and a more complicated plumbing system including a selector valve. Mr. Weick pointed to accident statistics that place the blame for many accidents on the failure of complicated plumbing systems and misuse of valves. Mr. Weick said that in the case of the PA-25, the general safety is enhanced more by the use of a fuselage tank with simple plumbing than by the use of wing tanks with a fuel pump. He recognized that the fuselage tank may be more likely to cause a fire following a crash, but said that the rearward position of the pilot (behind the hopper) and his ease of exit, coupled with his likelihood of remaining conscious and relatively uninjured in a crash, make it probable that he will be able to escape in case of fire.

A look at the cockpit would seem to substantiate this reasoning. It has a steel-tube turnover structure and a large fiber glass top pad to prevent the canopy from sinking into soft mud. Large windows provide easy exit and the shoulder harness straps are linked permanently to their respective sides of the seat belt, making the harness easy to slip into and out of by fastening or un-fastening a single buckle.

Also, the ten-inch space between the metal floor of the cockpit and the bottom of the fuselage would be a safety measure in the event of a crash in which the plane landed right side up.

Aside from safety considerations, the Pawnee offers other features of interest to applicators. The hopper tank has a 20-cubic foot volume and is constructed of polyester plastic reinforced with fiber glass for resistance to corrosion. Provided with a large sealed door that hinges forward and lies flat on the fuselage top when opened, the hopper opening is entirely clear of the wings, making for easy loading. Because the hopper is made of transparent fiber glass and is located directly in front of the

Cockpit (below) is designed to reduce the possibility of injury. Turn-over structure is sturdy and large windows provide easy exit. Hopper (right) can be installed or removed in minimum time since top of tank forms top of fuselage. Hopper is made of polyester plastic reinforced with fiber glass.

Piper Pawnee * Model PA-25

Specifications and Performance Data for Fully-Equipped Aircraft

SPECIFICATIONS

Engine	Lycoming 0-320
HP and RPM	150@ 2700
Gross Weight (lbs.)	2300
Empty Weight (lbs.)	1200
Useful Load (lbs.)	1100
Wing Span (ft.)	36.2
Wing Area (sq. ft.)	183
Length (ft.)	24
Height (ft.)	6.8
Power Loading (lbs/hp)	15.3
Wing Loading (lbs/sq. ft.)	12.5
Fuel Capacity (gals.)	40

PERFORMANCE

Top Speed	100
Cruising Speed (mph)	90
Stalling Speed (mph)	57
Take-off Run (ft.)	625
Take-off Over 50' Barrier (ft.)	1500
Landing Roll (ft.)	400
Landing Distance Over 50' Barrier (ft.)	930
Best Rate of Climb Speed (mph)	68
Rate of Climb (ft. per min.)	510
Best Angle of Climb Speed (mph)	65
Service Ceiling	10,000
Absolute Ceiling	12,000
Fuel Consumption (gal/hr, 75% power)	9
Cruising Range (75% power, miles)	400

pilot's control stick, the pilot actually can see the level of his chemical load at all times. The hopper is located approximately on the plane's center of gravity, so that no change in longitudinal trim is required as the load changes from full to empty.

The dispersal equipment on the PA-25 is designed for easy maintenance and quick switching over from dry to liquid chemicals. The bottom of the hopper has been designed with a gate that will seal satisfactorily in all cases, wet or dry.

The standard spray system uses the same one-inch Simplex centrifugal pump as the PA-18A but with improved seals. The nozzles are on a boom located to the rear and slightly above the trailing edge of the wing but which dips under the walkways and the fuselage. In this position, the boom is visible to the pilot and is protected from striking objects such as trees or brush.

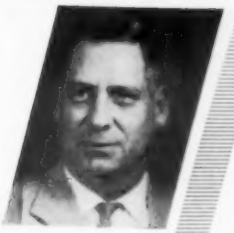
For dry chemicals, a venturi-type distributor has been developed for universal use, including dust, seed, and fertilizer.

A hinged motor mount provides accessibility for work at the rear of the engine, and all control, fuel, and instrument lines pass near the hinge axis so that the engine can be swung without disconnecting them. The side fuselage cowling panels are removable back through the front part of the cockpit. This gives easy access to the fuel tank, landing gear shock absorbers, the hopper region, rudder pedals, and controls.

Where feasible, structural materials have been used which will withstand corrosive chemicals. All steel parts are protected by corrosion-proof finish and the inside of all steel tubing is treated with Lionoil.

The first five Piper Pawnees were sold to aerial applicators in western Texas, where Piper service engineers are keeping accurate records of their operation.★★

PEST ROUNDUP



By Kelvin Dorward

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Survey & Detection Operations, Plant Pest Control Division, U. S. Department of Agriculture. His observations are based on latest reports from collaborators in U.S.D.A.'s pest surveys throughout the U.S.

Livestock Pest Apparently Becoming More Widespread

IN the September issue of *Agricultural Chemicals* reference was made to a muscid fly, *Musca autumnalis*, (corrected spelling), an insect known to be in this country since 1953, but only this year reported as being seriously annoying to livestock. The first record in the United States was from Long Island, New York, in 1953. In August the known distribution in the United States was listed as Illinois, Indiana, Maine, New York, Ohio, and Virginia. During August and early September the insect was reported from Massachusetts, New Hampshire, Michigan, Vermont and Pennsylvania. In McKean County, Pennsylvania, the flies became so abundant in one instance, that a white horse had to be kept in the barn. Reports of flies, suspected of being this species, were received from New Jersey and West Virginia.

The majority of the reports received refer to the fly as annoying to cattle, but horses and sheep are also listed. The fly does not enter barns, making residual barn sprays of little consequence in control.

The larvae develop in cow dung and various other kinds of excrement, and pupation occurs in the soil around the excrement. Adults suck blood and other exudations from the surface of mammals, but cannot pierce the skin.

Bollworm Eradication Program

THE pink bollworm eradication program initiated in 1958 in central Arizona, following the finding of the insect in Maricopa County, was continued in 1959. The program, a cooperative undertaking of the Plant Pest Control Division, U.S. Department of Agriculture, the Arizona Commission of Agriculture and Horticulture, the cotton industry and farmers, was conducted in Maricopa, Pima and Pinal Counties this year.

Insecticide applications began May 15, 1959, and were completed July 14. Eight applications either in dust or spray form were applied to 75,000 acres. DDT at the rate of 2 pounds actual per acre was used for the first four applications, and 3.75 pounds for the remaining. Sulphur was incorporated into the dusts as a miticide.

As of August 31 no pink bollworm moths or larvae had been taken within the treated area. Twelve moths, consisting of single catches, had been trapped outside the treated areas but within the regulated area.

Vector of Hoja Blanca in Louisiana

THE only known vector of the hoja blanca disease of rice was found in Louisiana for the first time in late July. This plant hopper, *Sogata orizicols*, was first found in St. Tammany Parish. The disease was found shortly after the initial find of the carrier. Through August the vector and/or evidence of the disease had been found in five rice fields totaling approximately 300 acres in St. Tammany Parish, in one field of 260 acres in St. James Parish, and in one field of 140 acres in Iberville Parish.

The vector, as well as the disease, was first found in the United States in an experimental plot of rice at Belle Glade, Florida, in the fall of 1957. Two additional infestations of 40 and 240 acres were also found in the same area later that year. In September 1958, the vector and disease were found in two fields in Hancock County, Mississippi. One field was of volunteer rice and the other a 60-acre planted field. Finds of the vector or disease were made in the Belle Glade, Florida, area in 1958 and in January 1959, but no further finds have been made in Mississippi. In all cases, eradicative measures were undertaken immediately after finding the insect or disease.

Hoja blanca disease, a virus disorder capable of seriously damaging this country's $200 million rice crop, was first found in the Western Hemisphere in Cuba in 1954. In addition to the United States records, it is now known to be in Cuba, Venezuela, Panama, Costa Rica, the Dominican Republic, Dutch Guiana, El Salvador, Guatemala and Colombia. In Cuba and Venezuela, yield reductions in affected fields have been estimated to be as high as 75 percent. An outbreak in Cuba in 1956 caused loss of 25 per cent of the rice crop.

General Insect Activity Notes

PERHAPS the most outstanding insect outbreak to occur during August was that of the corn

(*Continued on Page* 121)

NATA Plans Symposium

Preliminary plans for the 1959 convention of the National Aviation Trades Association, Nov. 16 to 20, at the Hotel Monteleone in New Orleans, call for a discussion panel to be comprised of representatives of chemical manufacturers. Among companies that will be represented on the panel are Geigy, Diamond, Du Pont, Rohm & Haas, Union Carbide, and Velsicol.

The speakers will report on new pesticides being developed for aerial application, as well as new application methods. The panel's theme will be, "New Business Opportunities for Agricultural Operators."

As in previous years, the program for the 1959 meeting lists concurrent sessions during the convention so that aerial applicators will be able to hear speakers on agricultural topics during most scheduled meeting periods. Other sessions will cover air taxi, training, and maintenance operations.

•

New High-Low Applicators

Two versatile applicating machines recently were introduced by the Century Engineering Corp., Cedar Rapids, Iowa, and the Gandy Chemical Co., Owatonna, Minn.

The newest addition to Century's line of spray equipment is a self-propelled high clearance carrier that can be used for spraying, applying granules, or topping. Accessory items, in addition to the three-section boom sprayer pictured on page 65, include a six-row granular insecticide applicator, four-row topper, hand gun, and jet type sprayer.

Gandy is offering the HiLo Granular Applicator that can be adjusted for row-crop or broadcast applications. It is shown on page 65 applying granules in bands over corn rows.

•

New Pesticides Review

At least 550 people attended the New Pesticides Review for Central California sponsored by the Western Agricultural Chemicals Assn. and held in Fresno, Sept. 10. The purpose was to "educate" rather than "legislate" the pesticide salesmen problem out of existence.

Henry C. Moore, a past president of the California Agricultural Aircraft Association, presented a talk on the problem of aerial applicators. He emphasized their problems of liability, legislation, and insurance from the viewpoint of one who might become liable, one who is forced to operate within legislation, and as a buyer of insurance. Mr. Moore asked the chemical salesmen to put themselves in the position of the aerial applicator when they make recommendations, to become familiar with the Miller Bill, and to acquaint themselves with the rules and regulations under which an aircraft is operated.

LISTENING POST

By Paul Miller

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Fungicide Treatment of Field Boxes to Control Fruit Rot

ROBERT E. Adams and S. E. Tamburo*, of the West Virginia University Agricultural Experiment Station, write that not all of the rather high loss, (frequently amounting to as much as 10 per cent or more) from rot of apples in cold storage can be accounted for by infection while the fruits are still on the trees. The possibility that the field boxes used for picking and storing apples might be a source of inoculum was strongly indicated when earlier studies in West Virginia demonstrated the presence of many different apple rot pathogens on these boxes. The authors report further experiments in which they obtained evidence that the reused field boxes actually do constitute an important source of inoculum, and that treatment of the boxes with fungicides results in partial control of infection from this source. Since it seemed probable that peaches, which are more susceptible to post-harvest decay than apples, could also be infected by inoculum from contaminated field boxes, they were included in the experiments.

Materials and Methods

Experiments with Apples: The apples for the experiments were grown on the West Virginia University Experiment Farm at Kearneysville, under the captan-lead spray program, as recommended for West Virginia. Field boxes in good condition, used for two or three seasons and stored in the station barns when not in use, were chosen.

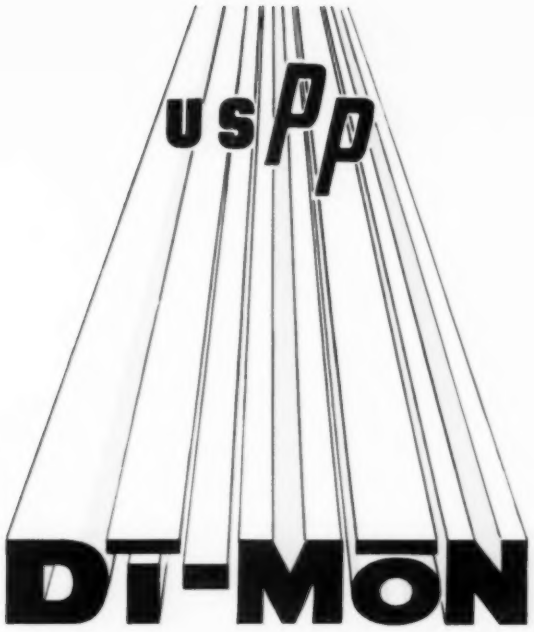
In 1957 the varieties were Red Delicious and Golden Delicious. Boxes used for harvesting and storing, 15 for each variety, were given nine different treatments, using a randomized block design, replicated five times. To be sure that inoculum was uniform, boxes for eight of the treatments were first sprayed with a spore suspension of 12 different fungi frequently isolated from storage boxes, including *Alternaria tennis*, *Epicoccum granulatum*, *Nigrospora oryzae*, *Fusarium* sp., *Cladosporium cladosporioides*, *Phoma pomi*, *Botryosphaeria ribis*, *Physalospora obtusa*, *Chaetomium globosum*, *Trichothecium roseum*, *Botrytis cinerea*, and *Rhizopus nigricans*. After this artificial contamination, the boxes were allowed to dry for 4 or 5 hours, then sprayed to the point of run-off with sterile water as one of the check treatments or with one of the following seven chemicals at the concentration noted: mercuric chloride 1:1000, cyclohexamide 5 parts per million, copper sulfate 4 pounds in 100 gallons water, captan 2 pounds in 100 gallons, glyodin 1 quart in 100 gallons, maneb 2 pounds in 100 gallons, zineb 2 pounds in 100 gallons. For the other check treatment, naturally contaminated boxes, carrying only the pathogenic spore load acquired during use without added inoculum, were sprayed with sterile water. Red Delicious apples were put into the boxes by the pickers and placed in refrigerated storage at once. Golden Delicious apples were stored after being sorted by hand to remove all diseased fruits. On December 16-17, 1957, after 2½ months of storage, diseased and healthy fruits in each box were counted.

In 1958 the varieties were Rome Beauty and Stayman Winesap. Boxes used were naturally contaminated, no inoculum being added as was done in 1957. The four chemicals tested included captan, zineb, Amobam (diammonium ethylene bisdithiocarbamate, 42 percent solution), and glyodin. For comparison, both unsprayed new boxes and unsprayed used boxes were included. Two series of experiments were conducted. In the first, the chemicals were applied by spraying, in the second by dipping. Both series were laid out in randomized blocks. The first consisted of six treatments replicated nine times for each variety, the second of five treatments replicated five times. The total number of boxes used was 158. The apples were picked directly into the boxes and placed immediately in refrigerated storage. Counts were made after about 2½ months, on January 2, 1959.

Experiments with Peaches: Experiments with Hale Haven peaches were made at two places, Kearneysville and Romney, in 1958. At each

(*Continued on Page* 113)

*Robert E. Adams and S. E. Tamburo, "Treatment of field boxes for the control of post-harvest rots of peaches and storage rots of apples," *Plant Disease Reporter*, vol. 43, no. 3, pages 396-400, March 15, 1959.



A Modified Di-ammonium Phosphate

18-46-0 GRANULATED

DIMON is a free flowing product of uniform particle size and guaranteed chemical analysis. It will not cake or set up under normal storage conditions. **DIMON** makes possible the production of most high and ultra high analysis fertilizers which cannot be made with conventional materials. **DIMON** can be used in a broader range of formulations, reduces material costs, increases production rates and produces a better conditioned fertilizer.

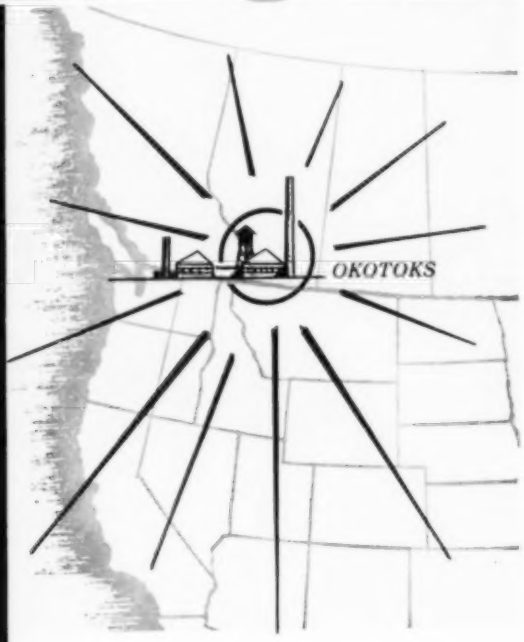
For scheduling and requirements – Contact our

Sales Agents
BRADLEY & BAKER

U.S. PHOSPHORIC PRODUCTS
TAMPA, FLORIDA
Division
TENNESSEE CORPORATION

SULPHUR

Spotlighting the new TGS Recovery Plant at OKOTOKS



OKOTOKS marks another step in the steadily broadening service being developed by TGS for industries in the States and Canada. Production from OKOTOKS, sitting on top of the vast "sour gas" field a few miles south of Calgary, Alberta, will add a significant tonnage to the supplies of Sulphur already available through TGS to the expanding industries in the Pacific Northwest. OKOTOKS is set up to make shipments of Sulphur in solid or molten form.

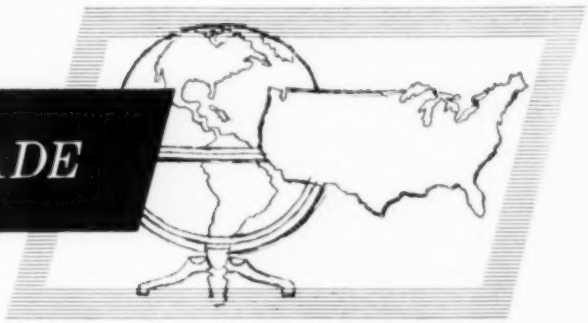
TEXAS GULF SULPHUR COMPANY

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units:

Newgulf, Texas • Spindletop, Texas • Moss Bluff, Texas
Fannett, Texas • Worland, Wyoming
Okotoks, Alberta, Canada

NEWS about the TRADE



K. D. Jacob Transferred

Kenneth D. Jacob has been named special assistant to the director of the Soil and Water Conservation Research Division, Agricultural Research Service, USDA, Beltsville, Md. He had been chief of the Fertilizer Investigations Research Branch at Beltsville.

He is succeeded in that post by William L. Hill, who had been head of the Fertilizer Materials Section.

•

Dow Sales At New High

The Dow Chemical Co., Midland, Mich., has announced that its sales in the fiscal year ended last May 31 reached a new high of $705 million. This compares with sales of $636 million in the previous year. Earnings totalling $63 million were 37 per cent higher than the $46 million earned 1958.

In the company's annual report to its stockholders, it was pointed out that Dow is accelerating its efforts to upgrade the basic chemical raw materials it produces, and to sell a wider line of finished products directly to consumers. Currently being tested is the sale of a small-package line of agricultural chemicals for home and garden use.

In elections following the company's 62nd annual stockholders meeting, Donald K. Ballman and C. B. Branch were elected vice presidents of Dow. Mr. Ballman is director of sales.

•

Named Sales Representative

Thomas P. Mericle Jr. has been appointed agricultural sales representative with headquarters in Louisville, Ky., for Sohio Chemical Co., Lima, Ohio. He has been with Sohio since July, 1958.

•

Ferguson Files Suit

Ferguson Fumigants, Inc., Ferguson, Mo., has filed suit in the U. S. District Court for the Northern District of Texas, alleging that the International Milling Co. of Greenville, Texas, is using a spot fumigant liquid dispensing apparatus, the use of which constitutes an infringement on Ferguson Fumigants' Patent No. 2,876,932.

Cyanamid To Move To Suburbs

The American Cyanamid Co. has selected a 180-acre tract in rural Wayne Township, Passaic County, N. J., as the site of its new administrative offices. Construction is expected to start this fall.

The new buildings have been planned in units which will be completed and occupied at intervals over a period of years and may eventually house a staff of 1,500 employees. Dr. W. G. Malcolm, president of Cyanamid, said that the firm's decision to locate this part of its operations in Wayne Township resulted directly from a cordial invitation extended by township officials. Wayne Mayor Robert A. Roe said that the company has purchased a site southeast of Pines Lake, south of Indian Road and west of Berdan Avenue in Wayne.

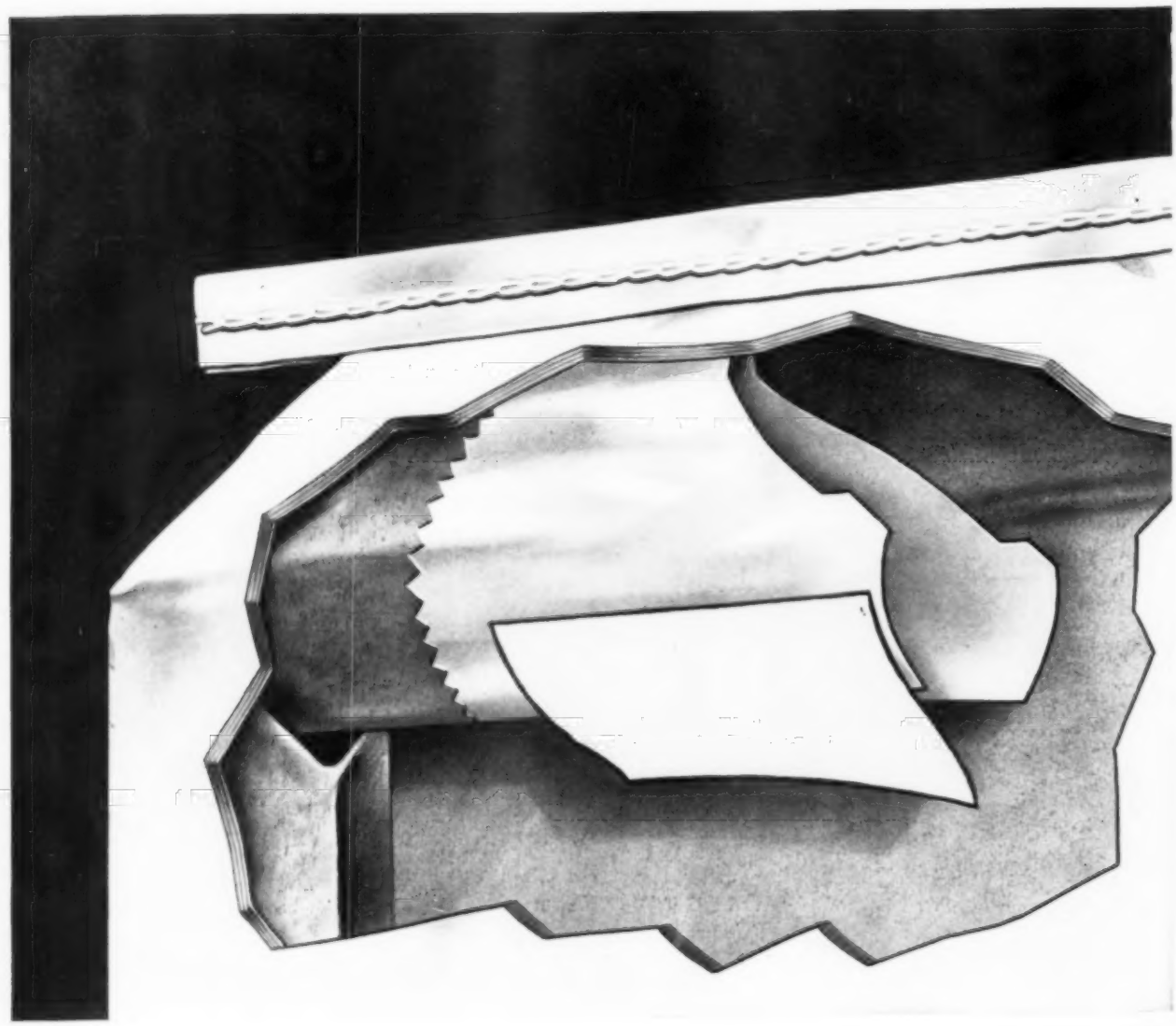
1958 Pesticide Production Was 5% Higher Than 1957

THE U. S. production of pesticides and other organic agricultural chemicals in 1958 came to 539 million pounds — about 5% more than the 512 million pounds produced in 1957, according to a preliminary report released by the U. S. Tariff Commission. The report gives preliminary statistics for 1958 on pesticides by principal uses — fungicides, herbicides, insecticides, rodenticides, soil conditioners, and soil fumigants.

Sales in 1958 were 467 million pounds, valued at $196 million, compared with 433 million pounds, valued at $178 million in 1957.

The output of cyclic pesticides and other chemicals included in the cyclic group amounted to 415 million pounds in 1958 — about 9% more than the 107 million pounds reported for 1957. Sales in 1958 were 378 million pounds, valued at $148 million, compared with 340 million pounds, valued at $132 million, in 1957. Of this group, DDT was produced in the greatest quantity in 1958. The DDT production of 145 million pounds was a record high for a single year.

The production of acyclic pesticides and other acyclic organic agricultural chemicals in 1958 amounted to 95 million pounds, compared with the 104 million pounds reported for 1957.



. . . Magic Yellow sewn

An ALL-NEW concept in valve construction . . . "DUETTE" is actually *two valves in one* with a DOUBLE CHECK ACTION. Thoroughly tested and proved siftproof, without packing trouble.

There's never been a sewn multiwall valve like it. It's NEW . . . not just another way of shaping, creasing, notching or slitting . . . but an *addition* that acts as a valve-on-a-valve, giving double sift protection.

Bemis "DUETTE" Valve Multiwalls, tested in full-scale production for over two years, have proved their superiority over other sleeve valve bags for a wide variety of products granular, pelletized or pulverized.

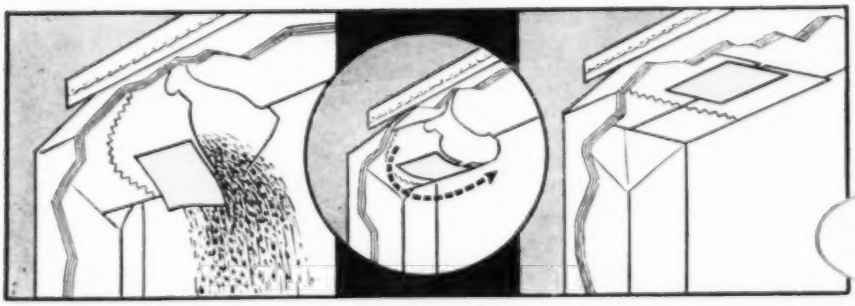
Try the Bemis "DUETTE." You'll be delighted with the results.

Write us for the *complete* story, or ask your Bemis Man. Samples on request.

IT'S ABSOLUTELY NEW AND DIFFERENT!

The Bemis "Duette" TRADEMARK

multiwall sleeve valve



WON'T CLOG . . . This view shows how the Magic Yellow check flap falls freely aside from the valve slit, giving no interference whatever to proper operation of the packing spout. The sleeve won't choke or clog the packer.

POSITIVE CLOSING ACTION . . . This diagrammatic picture shows action as the flap starts to close over the valve slit.

CAN'T SIFT . . . When the bag is filled, the Magic Yellow flap, acting as a check valve, *completely overlaps and covers* the valve slit, keeping the product from reaching the place where it might find a chance to sift.

Bemis

GENERAL OFFICES
408 Pine Street, St. Louis 2, Missouri
Sales Offices in Principal Cities

To Enlarge Plant

The American Potash & Chemical Corp., Los Angeles, has announced that work has begun to enlarge its sodium chlorate plant at Aberdeen, Miss., by 50 per cent. The expansion project will raise production capacity at Aberdeen from 15,000 tons per year to 22,500 tons. Completion is scheduled for Oct. 1960.

•

Calcium Arsenate Spray

Robert Hunter of the University of Arkansas entomology department has reported that his research indicates that calcium arsenate is effective as a contact insecticide against the cotton boll weevil. Calcium arsenate had been considered effective only when eaten by boll weevils.

In Mr. Hunter's research, boll weevils, with their mouth parts sealed, were dusted with calcium arsenate and the insecticide proved to be lethal. As a result of this and related research, calcium arsenate can be applied as a spray the report said. High suspension calcium arsenate is being used extensively for the control of cotton pests. Eight to ten pounds of HSCA in ten to 18 gallons of water per acre is said to give excellent control.

•

Staley Appoints Seidman

Dr. Martin Seidman has been appointed a process research group leader for the A. E. Staley Manufacturing Co., Decatur, Ill. Dr. Seidman joined Staley in 1957. He previously was with the Salvo Chemical Corp., Rothschild, Wisc., and the Visking Corp. in Chicago.

•

Deficient Pesticide Samples

Out of 116 samples of pesticides examined this past year by the New York State Agricultural Experiment Station laboratories, 36 were found to be seriously deficient with respect to their guaranteed composition and 19 were slightly deficient.

This compares favorably with previous years, according to Dr. G. L. Mack, station chemist. Older materials, he observed, are constantly being improved with respect to uniformity of quality, but newer materials coming on the market keep the number of deficient samples about constant.

•

Vice President of Moyer Co.

Earl W. Cannon has been appointed a vice president of the Moyer Chemical Co., San Jose, Calif. He had been manager of field marketing.

Prior to joining Moyer, Mr. Cannon was with the California Spray Chemical Corp. for 30 years. During the last ten years of his association with Calspray, Mr. Cannon served as director, vice president, and manager of marketing. He is a leading authority on the development and marketing of agricultural chemicals.

•

Wheeler Joins H. J. Baker

Franklin Wheeler has joined the New York office of H. J. Baker & Bro. He will assist in the development of new markets and general product promotion.

Mr. Wheeler had been sales manager for the Allied Chemical International Corp.

•

Forest Fertilization Grant

A grant of $800 has been made by the National Plant Food Institute to the Southeastern Forest Experiment Station of the United States Department of Agriculture for research on forest fertilization.

The studies will be conducted on young loblolly pine trees growing in the Piedmont section of South Carolina. The specific objective is to determine the best time of year to sample the foliage in order to best relate the nutrient status of the tree with the availability of nutrients in the soil. Dr. Carol Wells, soil scientist, and Dr. Louis J. Metz, leader, forest soils research, at the Union Research Center, Union, S. C., will supervise the investigations.

•

Poison Control Meeting

The second meeting of the American Association of Poison Control Centers is being held Oct. 6 at the Palmer House, Chicago.

Weed And Nematode Forum

The Spencer Chemical Co., Kansas City, Mo., is sponsoring a Weed and Nematode Forum, to be held in that city on Oct. 19 and 20. Dr. Alden Crafts, chairman of the department of plant-science at the University of California, will be chairman of the forum which will be featured by a panel of authorities on all phases of weed work.

Panel members include: Dr. Julius Feldmesser, USDA, Orlando, Fla; Dr. J. Roe Foster, superintendent of experimental farms, Indian Head, Saskatchewan; Dr. Dewey Raski, lecturer in entomology, U. of California; Dr. D. W. Staniforth, professor of botany, Iowa State College; and Dr. Warren Shaw, USDA, Beltsville, Md. The schedule calls for the forum to be opened by statements from the authorities involved, a general discussion and a question and answer period. An added feature of the forum, which will be held at Spencer's research center, will be an announcement concerning the results of the company's test program on a selective herbicide for the control of wild oats.

•

Zimmer Joins Cyanamid

Paul R. Zimmer has been appointed a field investigator for the agricultural division of the American Cyanamid Co., New York. He is assigned to the Midwest region, with headquarters in Kansas City, Mo.

•

Hooker Buffalo Office

The Hooker Chemical Corp., Niagara Falls, N. Y., has established a Buffalo district sales office in the Erlanger Building, Buffalo. The newly-created Buffalo sales district for Hooker's Eastern Chemical Division will include the state of New York, excluding the metropolitan area of the city of New York, Canadian areas near Lake Ontario, western Pennsylvania, Ohio, West Virginia, and Kentucky.

Charles H. Foster Jr. is manager of the new sales district.

Arcadian® News

Volume 4 | For Manufacturers of Mixed Fertilizers | Number 10

The No. 1 Need of Most Crops

More N in N-P-K

Consumption of all three major plant foods has risen rapidly in recent years, as farmers use more fertilizer to produce higher yields per acre. But, yields and profits from fertilizer are still far below the maximum returns that can be produced with fertilizer.

The reason is simple. Most crops do not get the amounts and analyses of fertilizers they need to produce optimum yields and profits. *The average fertilizer is far too low in nitrogen.* In addition to failing to supply the nitrogen needs of crops, it also limits the efficiency of its phosphorus and potash content because these plant foods cannot function properly without sufficient nitrogen available to crops.

The leading fertilizer-consuming crops need more nitrogen than any other plant food. Corn, wheat and cotton require more than twice as much nitrogen as phosphoric acid, and much more nitrogen than potash. Modern grazing and hay crops are big users of nitrogen. Animal products produced on farm-grown feeds remove from the soil more nitrogen than phosphoric acid and potash combined.

Yet, in 1957-58, the plant food content of the average mixed fertilizer was 5.95% N, 12.55% P_2O_5, and 11.76% K_2O. If this analysis was used on corn, cotton and wheat, it would supply only about one fourth of the nitrogen needed to balance its phosphoric acid and potash.

Challenge and Opportunity

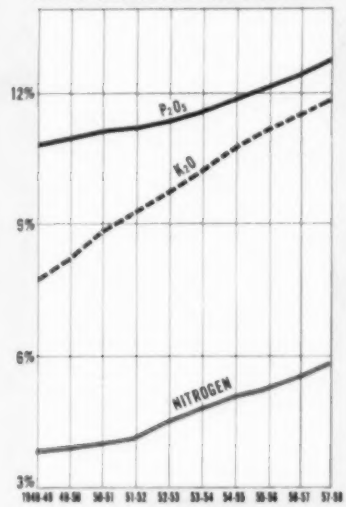
In the same year, total consumption of materials and mixed goods accounted for 2,292,000 tons of phosphoric acid and 1,935,000 tons of potash. The 2,284,000 tons of nitrogen used was only about one-third to one-half of that needed to balance the other plant foods in supplying crop needs.

And, experiment stations tell us that crops could use much greater amounts of phosphoric acid and potash efficiently and profitably, if these plant foods were balanced with sufficient nitrogen.

It is true that conditions vary. Some crops and soils need more nitrogen than other crops and soils. But the national picture clearly indicates that low-nitrogen content is the chief limiting factor in the ability of the average mixed fertilizer to produce maximum yields and profits.

This situation is a challenge and an opportunity to every fertilizer man. It calls for vision, progressive enterprise and hard selling. Start now to make it your aim and purpose to manufacture *really* complete fertilizers that contain enough nitrogen in balance with other plant foods to produce the best possible return per dollar invested by the farmer. Success in attaining this goal offers rich rewards to you and your customers.

AVERAGE PLANT FOOD CONTENT OF MIXED FERTILIZER IN U. S.



New Ammoniation Techniques

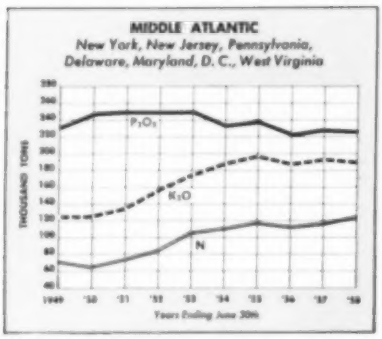
Today it's easier than ever before to put more N in N-P-K. High-quality, high-analysis, high-nitrogen mixed fertilizers can now be manufactured efficiently and economically through the use of new, improved ammoniation techniques. For complete information, contact: Nitrogen Division, Allied Chemical, 40 Rector Street, New York 6, N. Y.

More N in N-P-K can help you sell more and better fertilizers that pay bigger profits to you and the farmer.

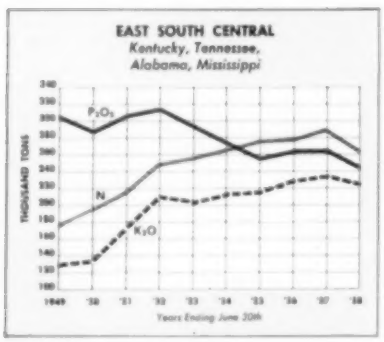
Arcadian News for Fertilizer Manufacturers . . . . . from NITROGEN DIVISION

TOTAL PLANT FOOD CONSUMED BY EACH AREA OF THE U.S.

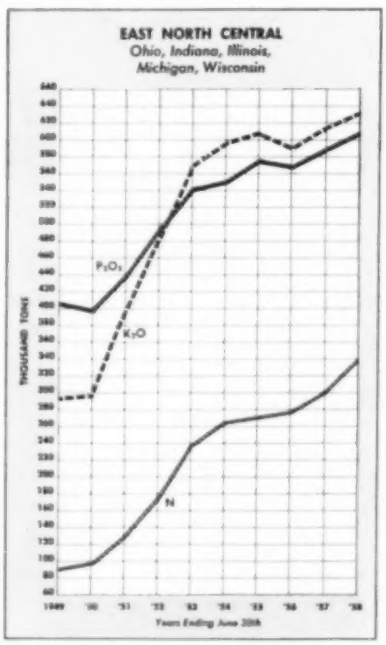
These charts graphically portray the ratio of the three major plant foods for each area of the country, based on figures for total consumption including both mixed fertilizers and straight materials. The figures for the area or areas in which you operate will be helpful to you in assessing the present situation and in making plans for the future. Most of these area charts indicate big potentials for more N in N-P-K.



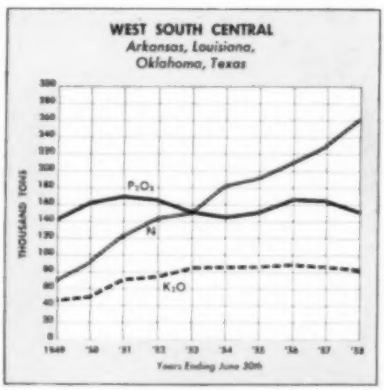
MIDDLE ATLANTIC states have many sections in which high-phosphate fertilizers have built up a soil reserve of this plant food. In New York and New Jersey especially, high-nitrogen fertilizer can make crops get up and grow profits, just as in New England. Since both of these Northeastern areas are traditional users of mixed fertilizer, high-nitrogen combinations fit easily into the sales pattern.



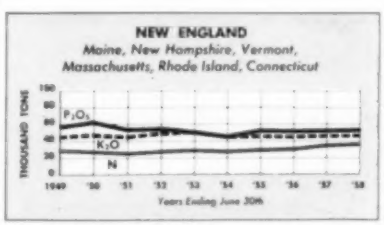
EAST SOUTH CENTRAL states, with the exception of the Mississippi Delta area, are low in fertilizer use. The intensive Delta cash crop area has taken to heavy use of nitrogen and high-nitrogen ratios of plant food. While financing has been no problem on these large farms, the reverse is true on most of the typical small farms of these states. More work to show the value of fertilizer to banks and other groups who are financing farmers can pay off well for fertilizer men.



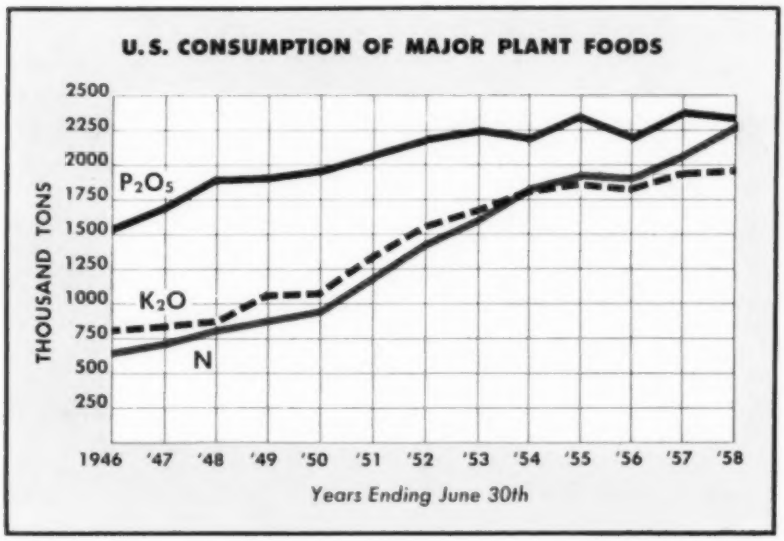
EAST NORTH CENTRAL states show an amazingly low level of nitrogen in fertilizer in proportion to phosphoric acid and potash. In this new fertilizer area, use of all three plant foods is increasing fast, but far more nitrogen is needed to boost crop yields at lowest cost. With intensive cropping of land on the increase, there is a big opportunity to sell more 16-8-8 and other concentrated mixes for grain and grass crops. Experiment stations are beginning to recommend more nitrogen, and legumes cannot furnish it economically. Balanced starter fertilizers should also come fast, with the new planter attachments available.



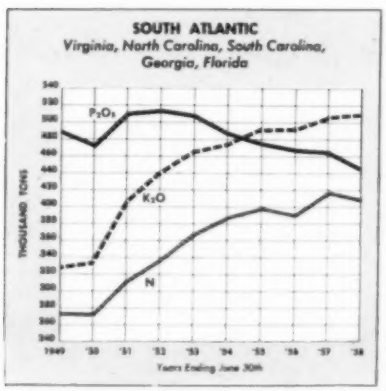
WEST SOUTH CENTRAL states have many large commercial producers of cash crops who have realized the value of balanced fertilizer, as the chart indicates. The use of plant foods has improved fast, and is producing profitable yields of cotton, rice and other crops. Extra sales can be made by demonstrating to the smaller farmers of the area that they too can make money by using a larger tonnage of fertilizer.



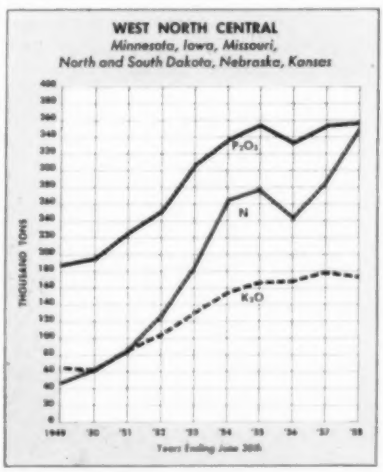
NEW ENGLAND soils, with a few cash crop exceptions, are now mostly in grass



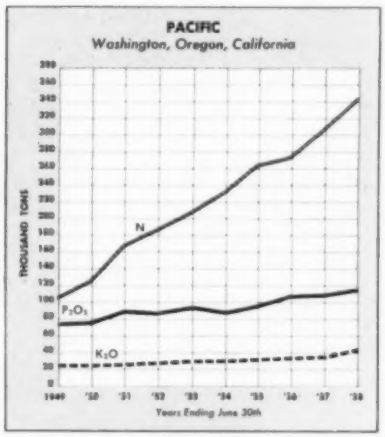
and grass-legume mixtures. Traditional use of nitrogen on these old soils has been small. Heavy use of superphosphate has built up a reserve of phosphoric acid in the soil, without greatly increasing yields. On these fields, high-nitrogen fertilizer can make grass yields jump. It can help grass make good use of the phosphorus in the soil and help reverse the downtrend in sales of phosphoric acid in fertilizers. In much of this area, high-nitrogen fertilizer for grass enables this crop to compete economically with legumes in feed produced per acre.



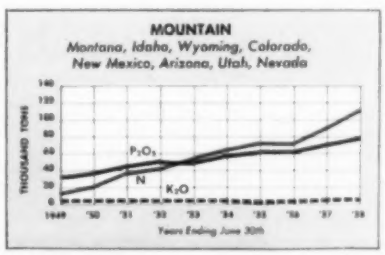
SOUTH ATLANTIC states, with the exception of highly-fertilized tobacco, citrus and vegetable areas, also show similar accumulation of phosphate reserves in the soil. Crop yields are low, indicating the need for more plant food of all kinds. With livestock numbers expanding, grass is becoming the big crop, and nitrogen is far less apt to be lost through leaching. Midland and Coastal Bermuda, Bahia, Pensacola and other grasses are a major new market for high-nitrogen mixed fertilizers. And Georgia, for example, aims to grow enough corn for all its cattle and poultry. If farmers move up from 23 bushels per acre, their present average, to 100 bushels per acre on 2,700,000 acres, they will use a lot of fertilizer.



WEST NORTH CENTRAL states are new in fertilizer use, but recent increase in tonnage has been rapid, especially in Missouri and Nebraska. Use of nitrogen is proving profitable on range grass as well as irrigated meadows, corn and other cash crops. Missouri is using considerable nitrogen in proportion to phosphoric acid and potash. Soil supplies of potash have been naturally good in some areas, but heavy cropping will deplete them. Nebraska, with a 3-to-1 ratio of N to P_2O_5, has found heavy use of nitrogen profitable. High fixed costs on irrigated land and rapidly rising land values in the entire area have made more intensive cropping vital. This calls for more fertilizer, especially nitrogen, to cut costs per unit of crop production.



PACIFIC COAST states have taken to fertilizer in a big way, especially California. The combination of irrigation, sunshine and intensive cash crops on large farms has built fertilizer tonnage fast. This area shows the best use of nitrogen in proportion to other plant foods to fit crop needs. It is the nearest to a model area on balance of nutrients. Perhaps some fertilizer men in this area can demonstrate the economies of a balanced mixed fertilizer compared to the practice of using straight materials.



MOUNTAIN states have a wide variety of farm and ranch conditions. Fertilizer use is heaviest in irrigated areas. Balanced fertilizer in ratios to fit the crop and soil conditions can make bigger profits—whether on the range, in mountain meadows or on cash crops.

MODERN CROPS NEED MODERN FERTILIZERS

FARMING is undergoing a revolution in this country. Farms are growing bigger and modern, labor-saving, money-making methods are being rapidly adopted. Yet, many farmers continue to use old-fashioned amounts and ratios of fertilizer. By failing to know and supply the plant food needs of their crops and soils, they limit their return from land, labor, seed and machinery.

The time is ripe for a change to modern fertilizer practices and it is up to the fertilizer industry to help to speed that change. The manufacturer who supplies the farmer with easy-to-use complete fertilizers carefully designed to fit his particular needs helps both himself and his customer to prosper. This requires an accurate knowledge of the exact needs of crops and soils . . . efficient formulation and manufacturing techniques, using modern methods and materials . . . and aggressive promotion, education and selling.

Farmers and farming areas that break with tradition and use improved fertilizer practices are far ahead of the average in yields and profits. And fertilizer manufacturers who foster these improved practices are usually far ahead of the average in sales and profits.

Because the average mixed fertilizer is so low in nitrogen, you can take a giant step toward improved fertilizer practices in your area by producing, promoting and selling grades that contain sufficient nitrogen to supply crop needs for big yields. Many fertilizer manufacturers have found that it pays to double and triple the nitrogen content of mixed fertilizers for certain crops.

It Pays to be Progressive

Ten years ago, who would have suggested 320 pounds of nitrogen per acre of corn, even on irrigated land. Thousands of Nebraska farmers now use it and produce 150 to 200 bushels of corn per acre.

What agronomist 10 years ago would have advised more than 600 pounds of nitrogen per acre of grass. Georgia and South Carolina farmers now use two or more tons of 16-4-8 fertilizer per acre of Coastal Bermuda grass and produce 10 tons or more dry-weight, high-quality forage per acre.

Even timothy hay in the Northeast, once a one-ton, once-a-year crop of low feed value, is now producing four tons of high-protein hay per acre plus months of after-growth grazing, with high-nitrogen mixed fertilizer.

The Pacific Coast states, especially California, use the highest ratio of nitrogen to other plant foods, and California leads all other states in average corn yield, 75 bushels per acre, as compared to 60 for Iowa and 50 for the U. S.

Outstanding Results

Wherever states, counties or individual fertilizer companies have stepped out and really tried to do a better job of supplying the actual plant food needs of crops and soils, results are outstanding. Georgia is an excellent example. In Wisconsin and other corn states, where "prescription" fertilizing has been tried, it is building big yields and big fertilizer sales for entire counties.

New machinery is encouraging the use of heavier applications of high-analysis, high-nitrogen fertilizer. An excellent example is the new planter attachments that apply starter or row fertilizer to one side and deeper than the seed. In tests, 1,000 pounds of 10-10-10 per acre was applied to corn by this method without seed damage. 3-12-12 and 4-16-16 are not efficient when you can supply all the nitrogen the crop needs with one application of high-nitrogen complete fertilizer. One sale replaces two.

For many crops, high-nitrogen mixed fertilizers are now sold in competition with low-nitrogen mixtures plus top-dressing or side-dressing materials. One application does the work of two, saving labor for the farmer and increasing the volume and the profit of the manufacturer and the dealer. Off-season and bulk spreading is just as practical with high-nitrogen mixed fertilizer as with any other material. The era of legumes in short rotations is disappearing as many farmers find it more profitable to buy high-nitrogen fertilizers rather than to spend a year growing a legume crop.

Alert manufacturers and their salesmen and dealers are using soil tests, tissue tests, plant food removal charts and field demonstrations to promote high-nitrogen mixed goods designed to meet exact needs.

The need for nitrogen is nation-wide. It's the No. 1 need of most crops. This need will be supplied with high-nitrogen complete fertilizers or with low-nitrogen mixtures plus straight materials. It will pay you to take the initiative. Start now to sell more N in N-P-K!

In U. S. Borax Realignment

H. Riemer

J. F. Corkill

The United States Borax & Chemical Corp., Los Angeles, has realigned its management structure with the establishment of five functional departments to replace a divisional organization based on product lines.

R. T. Edgar

The new corporate structure includes five vice presidents who will serve under Hugo Riemer, exec. vice president. They are: J. F. Corkill, former vice president and general manager of the Pacific Coast Borax Division, who now is in charge of industrial and agricultural marketing; R. T. Edgar, former vice president for production in the Pacific Coast Borax Division, who is in charge of production of all company products; D. V. Parker, who continues in charge of 20 Mule Team Products marketing; R. F. Steel, former vice president in charge of finance and administration, who becomes treasurer and head of the administrative department; and Dr. D. S. Taylor, former vice president and general manager of the U. S. Borax Research Corp., who heads the technical department.

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Clupak Promotion Campaign

Clupak, Inc., New York, owners of the trademark and patents covering the manufacture of Clupak stretchable paper, has started a promotional campaign that is designed to make Clupak "not only a part of American life, but a part of the American language."

The campaign is aimed initially at business executives.

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NFSA Meeting Nov. 8

Among the speakers at the Nov. 8 to 10 meeting of the National Fertilizer Solutions Association in the Statler-Hilton Hotel, St. Louis, Mo., will be Edgar W. Sawyer Jr., research supervisor for the Minerals & Chemicals Corp. of America, Menlo Park, N. J.

Mr. Sawyer will speak about the stabilization of liquid fertilizers with Attagel 30, a product of Minerals & Chemicals Corp. He joined the company in 1953 as a research chemist and became a senior research chemist in 1955.

Other subjects to be discussed at the meeting include: Why Are You in Business?; Selling for Profit; and Solutions and Suspensions. Thirty-one companies have reserved conference rooms for the convention.

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Manager of Agrico Office

B. L. Emkes has been named manager of the American Agricultural Chemical Co.'s Seymour, Indiana, sales office. He had been assistant manager.

Control Officials Meeting

Among the speakers at the meeting of the Association of American Fertilizer Control Officials, to be held in conjunction with the meeting of Chemical Control Officials, in Washington, D. C., Oct. 15 and 16, will be Dale C. Kiefler, Smith-Douglass Co., Norfolk, Va., discussing "In-Plant Shrinkage."

Other speakers include: Dr. A. J. Duncan, Johns Hopkins University, Baltimore; M. B. Rowe, Virginia Department of Agriculture; R. C. Crooks, Florida Department of Agriculture, and Dr. Stacey B. Randal, New Brunswick, N. J. Also included in the program will be reports of committees.

Cotton Pests Reported To Show Tolerance In USDA Tests

BOLL weevils and cotton fleahoppers have been shown by Department of Agriculture scientists to resist chlorinated hydrocarbon insecticides normally used for their control in the important cotton-producing area of central Texas, according to a USDA report released last month.

Results from 1958 tests on several central Texas farms confirm the widespread nature of boll weevil resistance, and include the first evidence in the United States of resistance by the cotton fleahopper, according to workers of USDA's Agricultural Research Service. ARS scientists C. R. Parencia and C. B. Cowan Jr. showed, however, that effective control of the pests can be achieved with phosphate and carbamate insecticides as well as with a 2:1 combination of Toxaphene and DDT.

Tolerance of weevils to Dieldrin and Toxaphene apparently increased to such a degree that satisfactory control of heavy infestations with these insecticides was said to be impossible during the 1958 tests. Since 1955, cotton growers in some areas of Louisiana, Mississippi, Arkansas, and South Carolina have been reporting similar experiences.

Cotton fleahoppers resisted test dosages of Dieldrin, Heptachlor, and Toxaphene, at strengths up to three times more concentrated than those previously used to maintain control, the scientists reported. The populations of young fleahoppers increased on the infested plants during treatment with these insecticides, showing that lack of control was not due to new migrations of adults into the area.

In one experiment, a previously effective dosage of toxaphene reduced the population of overwintering weevils only 65 percent and failed to establish effective control over cotton fleahoppers. On the other hand, Guthion, an organic phosphate, and Sevin, a carbamate, gave a 90-100 percent reduction in weevil population and good control of the fleahopper. Of the total squares examined about a month after the initial treatment, scientists found an average of 8.4, 7.6, and 22.6 percent weevil-infested squares in the plots treated with Guthion, Sevin, and Toxaphene, respectively.

Toxaphene-treated plots in the same test reportedly yielded 300-400 fewer pounds of seed cotton than those treated with Guthion and Sevin, demonstrating a lack of adequate control of the two pests with toxaphene, the report said.

V-C Sales Up, Earnings Down

The Virginia-Carolina Chemical Corp., Richmond, Va., reported net sales in the fiscal year 1958-59 of $81,481,965, an increase of $13,958,780 over the previous year. Earnings, however, were reportedly down by $300,000.

The company listed royalties of $1,237,849 on phosphate lands which were not leased by the company in 1958 in its costs for 1959 and a loss on disposition of fixed assets of $32,841. In 1958, the company made a profit of $222,631 on the disposition of fixed assets. This, and increased operating costs, accounted for the decline in earnings.

The company also announced that a new fertilizer plant is under construction in Jasonville, Ind., and is expected to be in operation late this year. The 1959 fiscal year was reported to be the biggest year in the history of V-C's fertilizer division. A bonus incentive program for fertilizer sales personnel and more extensive advertising and sales promotion were credited with bringing about the record sales.

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Fertilizer Round Table, Nov. 4-6

Practical problems and techniques involved in the production and processing of fertilizers is the theme of the annual Fertilizer Industry Round Table to be held November 4-6 at the Mayflower Hotel, Washington, D. C. Vincent Sauchelli, fertilizer technologist with NPFI, is chairman of the meeting. Complete details on the program were reported on page 51 of the September issue of *Agricultural Chemicals*.

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Forms Consulting Service

Amos E. Badertscher, for 30 years an entomologist and horticulturist in charge of the insecticide department of McCormick & Co., Baltimore, retired last month to form a consulting service in Balto.

Mr. Badertscher served for several years as chairman of the insecticide scientific committee of the Chemical Specialties Manufacturers Association, during the period when the Official Test Insecticide (O.T.I.) was developed.

•

FMC Advances O. Johnson

Oscar H. Johnson has been named assistant to division manager, Niagara Chemical Division, Food Machinery and Chemical Corp. Dr. Johnson comes to this position at division headquarters in Middleport, N. Y. from the New York City office of FMC where he has been director of research and development for the Organic Chemicals Department.

Dr. Johnson joined the FMC organization in 1946 when he was in charge of organic research for Niagara. From 1948 to 1954 he held research management positions with the Westvaco Division at South Charleston, West Virginia and in New York. Following that, he was named Director of Research and Development for Niagara, and during the years 1954 to 1958 was responsible for the expanded and accelerated research program at Niagara.

•

Heads New Chemagro Section

James R. Costello has been named to head the combined operation of the Process Development Section and the Pilot Plant Section at Chemagro Corporation, Kansas City, Mo. Formerly operated separately, the two sections have been combined and will now function as an integrated unit to be known as the Process Development Section.

Two other personnel changes were announced in connection with the consolidation. Kenneth H. Rattenbury has been promoted to assistant supervisor and will be in charge of the pilot plant group.

IMC Announces 1959 Series Of Sales Training Clinics

INTERNATIONAL Minerals & Chemical Corporation will conduct a new series of sales training clinics this fall for salesmen of fertilizer manufacturing companies.

The ten sessions, scheduled for ten cities between October 12 and November 13, follow up last winter's series of meetings across the United States and Canada, which were praised by those attending as one of the most significant steps forward in the plant food industry in recent years.

Total attendance this year is expected to be almost 500. Last year more than 350 representatives of 156 fertilizer manufacturing companies attended the meetings, and many are returning with additional members of their sales and executive staffs.

This year's meeting will feature completely new material for increasing fertilizer sales.

New slides, movies, and other visual aids will be used, and there will be skits depicting certain sales situations. The meeting programs will include several audience participation features.

Topics to be covered include: Sources of sales; buying motives; credit and the salesman; the plus from soil tests; planning your strategy; stretching selling time; low price vs. high quality; closing your sales; keeping your customer sold; the key to the customer's mind; making your job easier with sales tools; fertilizer—an investment, not a cost.

The sales meetings are offered as part of IMC's Full Orbit Customer Service program. The schedule of meeting cities and dates:

October 12-13—
Kansas City, Missouri
October 15-16—
Shreveport, Louisiana
October 19-20—
Atlanta, Georgia
October 22-23—
Tampa, Florida
October 26-27—
Raleigh, North Carolina
October 28-29—
Baltimore, Maryland
November 2-3—
New York, New York
November 5-6—
Columbus, Ohio
November 9-10—
Indianapolis, Indiana
November 12-13—
Minneapolis, Minnesota

NOW you can formulate high concentrate wettable powders at low cost with MICRO-CEL

SUBSTANTIAL FORMULATION SAVINGS

Micro-Cel*, a new line of synthetic calcium silicates, has extremely high absorptive properties. It is this remarkable capacity for absorption that makes it possible to prepare wettable powders with higher concentrations of dry, viscous or liquid poisons. Micro-Cel's absorption also means that more lower cost diluents can be used. Thus high strength formulation costs are now cut to a new low.

REMAINS FREE-FLOWING—MEETS STORAGE TESTS

With Micro-Cel, these high concentrates will remain in a free-flowing state even after prolonged storage. This is particularly important in producing poisons for the export market.

In addition, suspension values after storage of 1.5 to 2.0 I.C.A. have been achieved in 75% DDT wettable powders, based on Micro-Cel. This is more than adequate for storage conditions encountered in most tropical countries.

DEVELOPED BY JOHNS-MANVILLE RESEARCH

Micro-Cel is another development of Johns-Manville Research. Combining high absorption, large surface area, small particle size and excellent dry flowability, it offers a unique combination of properties for insecticide formulation and other process needs.

Sample quantities and carload shipments are now available. Write for further data and sample formulations for poisons of interest to you. Or ask a Celite engineer to help you adapt Micro-Cel to your particular requirements and specifications.

*Micro-Cel® is Johns-Manville's new absorbent-grinding aid designed specifically for the insecticide formulator.

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Please send ☐ further information; ☐ samples of Micro-Cel. I am interested in using Micro-Cel with the following poisons:

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☐ Please have your local representative contact me.

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

Correction on Orchard Report

Dr. Stanley C. Hoyt, State College of Washington, calls to our attention several errors in the report on meeting of the Washington State Horticultural Association, and western orchard tours, which appeared on page 46 of the September issue of *Agricultural Chemicals*.

Dr. Hoyt points out that although there *may* be a resistance to Kelthane by mites in the Wenatchee area, it is still only a "suspected resistance", since more data is needed for definite proof of resistance.

A fact not emphasized in the *Ag Chem* report, writes Mr. Hoyt, is that the mite problem is severe in Washington orchards, but that the lack of control with Kelthane is localized, and has occurred only in a minority of western orchards.

He also calls attention to a statement indicating that "Tedion is the only material providing commercial control of two spots", appearing in the *Agricultural Chemicals'* report, and points out that the statement applies to two particular orchards and not the entire area. "Kelthane and some other materials give commercial control in the greater percentage of our orchards", adds Dr. Hoyt.

In the third column on page 46 (September issue), discussion of the rosy apple aphid is reported. Mr. Hoyt points out that his remarks at the meeting on control obtained with Dimethoate (American Cyanamid 12880) was on the green apple aphid, and that the material has not been tested against the rosy apple aphid.

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N.E. Fertilizer Conf. Held

Some 250 farmers, industry and government representatives attended the Northeastern Fertilizer Conference held September 24-25 at the Biltmore Hotel, New York City, sponsored by the National Plant Food Institute. NPFI regional director, W. H. Garman presided at the meeting and reported on NPFI activities. Paul T. Truitt, NPFI executive vice president reported on governmental affairs, and Russell Coleman, NPFI executive vice president discussed the work of the research and education division.

H. P. Sprague, Pennsylvania State Univ., talked on "Livestock production in the northeast"; and A. J. Wells, GLF, on a "Five-star demonstration program."

ESA Meeting in Detroit

The first joint meeting of the Entomological Society of America, the Entomological Society of Ontario and the Entomological Society of Canada will be held Nov. 30-Dec. 3, at the Hotel Sheraton-Cadillac, Detroit, Michigan. The theme of the meeting is biological pest control.

Garden Products Are Feature of National Hardware Show

WITH what was termed the largest and most varied assortment of lawn and garden products ever assembled, the National Hardware Show was held, Sept. 28 to Oct. 2, in the New York Coliseum.

E. I. du Pont de Nemours & Co., Wilmington, Del., exhibited a new pest control program for home gardeners that features a Du Pont hose sprayer with three snap-in nozzles.

Nine special-purpose plant foods are being offered by the American Agricultural Chemical Co., New York, to gardeners and home-owners. The plant foods are packaged specifically for such crops as shrubs, turf, ornamentals, and gardens.

Four new herbicides were among the products displayed by the Miller Chemical & Fertilizer Corp., Baltimore. Packaged in bags, they are Crabgrass Killer, 2,4-D Broadleaf Weed Killer, pre-emergence Crabgrass Killer, and Chickweed and Clover Killer.

O. E. Linck Co., Clifton, N. J., was on hand with its complete line of garden chemicals headed by Di-Met for pre-emergence crabgrass control. Linck also displayed its wheel-pump lawn sprayers. The sprayers are offered in two sizes this year: the regular 24 inch sprayer and a larger Estate Sprayer for use on golf courses and parks.

One of the most complete lines of garden chemicals being offered this year was presented by the Science Products Co. of Chicago. In addition to the standard pesticides, Science Products offers hormones and growth regulators. New this year are Blossom-Set and Berry Set. Blossom-Set is for use on flowers and vegetables and is said to stop blossom drop, resulting in earlier ripening of vegetables.

Faesy & Besthoff, Inc., New York, exhibited its 1960 line of agricultural products for gardens and homes.

An innovation in the California Spray-Chemical Corp.'s display was the aluminum foil container for its powdered products. Each box is provided with two spouts; one for pouring and one for shaking. Calspray also displayed eleven editions of its Ortho Lawn & Garden Book to cover each of eleven different geographical locations in the U. S.

The Terra-Lite Division of the Zonolite Co., Chicago, exhibited its Terra-Lite and Terra-Lawn soil and lawn products.

The Union Carbide Consumer Products Co., division of Union Carbide Corp., New York, displayed the Eveready line of garden products.

Two new products seen at the booth of Amchem Products, Inc., Ambler, Pa., were No-crab, an all-purpose treatment for lawns, parks, trees, fairways, and cemetaries; and X-all, an organic general weed killer for use on driveways, patios, tennis courts, and any area where a complete kill of weeds and grasses is desired.

Velsicol Chemical Corp., Chicago, displayed a collection of gifts that are to go to dealers as a means of encouraging Chlordane displays. Among the gifts were tumblers, fishing rods, and pen sets.

THE HEPTACHLOR INSECTICIDE 1960 DEALERS' "SALES-BUILDER" PROGRAM

The Most Comprehensive Insecticide Sales Support Ever Offered!

INSECT CONTROL REFRESHER COURSE—This simplified nine lesson course covers insect control information that you and your employees can use to increase sales.

INSECT CONTROL GUIDE SHEETS—Each sheet describes the appearance, life cycle, habits, damage and control of a specific insect.

INFORMATION SERVICE—A periodical newsletter will bring you the latest insect control information, and provide a continuing source of selling ideas.

ADVANCE COPIES OF PROMOTIONAL LITERATURE—As a participating dealer, you will receive advance copies of Heptachlor literature and promotional materials.

NO PURCHASING REQUIRED!—Whether you now sell insecticides containing Heptachlor or not, you are eligible for this program. There's no cost or obligation!

CHLORDANE PROGRAM—If you sell lawn and garden insecticides, send for complete information about the Chlordane "Off The Shelf" Program for small package dealers.

FORMULATORS... DISTRIBUTORS... MAIL COUPON FOR COMPLETE DETAILS!

The Heptachlor sales-builder program provides a continuous flow of educational and sales information. It will help salesmen and dealers during the busy spring and summer season, and give them a wealth of sales training material to use during the fall and winter. Mail the coupon now for complete details.

VELSICOL

VELSICOL CHEMICAL CORPORATION
330 East Grand Avenue, Chicago 11, Illinois

Please send complete information about the Heptachlor Dealer "Sales-Builder" program. ☐ Formulator ☐ Distributor ☐_____

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Vulcan 2522

S. C. Plant Food Society

The South Carolina Plant Food Educational Society will hold its annual meeting on Nov. 9 at the Clemson House, Clemson Agricultural College, Clemson, S. C.

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New Allied Herbicide

A new weed and brush killer developed especially for the control of deep-rooted weeds and hard-to-kill weed trees is being introduced by the General Chemical Division of the Allied Chemical Corp., N. Y.

Trade named "Urab," the herbicide is said to be effective against scrub oak, wild hickory, sassafras, poison sumac, and other weed trees. It also will control such weeds as trumpet vine, briars, cattails, and Canada thistle, General Chemical reports. Urab (3-phenyl-1, 1-dimethylurea trichloroacetate) is soluble in water which adds to its effectiveness. Once Urab is sprayed on the soil, rain water will carry it down into the deep root zone.

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Pan American Terminal Opens

The Pan American Sulphur Co., Houston, Tex., has placed in operation new liquid sulphur loading facilities at its Black Point Terminal on Tampa Bay in Tampa, Fla.

The company's sulphur terminal has easy access for both tank trucks and tank cars. Tank trucks have a delivery radius of 150-200 miles.

Heads Eastern Region

Dr. R. E. Wagner, former head of the agronomy department at the University of Maryland, has joined the American Potash Institute as director of its Eastern Region.

An authority on forage crops, Dr. Wagner will serve the states from Virginia through Maine, in association with Dr. S. E. Younts, eastern agronomist for the Potash Institute. Dr. Wagner joined the USDA plant industry station at Beltsville, Md., in 1945 and worked for the USDA in various capacities until 1956, when he joined the staff of the University of Maryland as head of the agronomy department.

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CFA To Hear Panel

R. L. Luckhardt, Collier Carbon and Chemical Corp., Los Angeles, will be moderator of a panel discussion on technical progress and business stability at the 36th annual convention of the California Fertilizer Association, to be held at the Fairmont Hotel, San Francisco, Nov. 9 to 11.

Appearing on the panel will be: Floyd Hornibrook, Best Fertilizer Co., Lathrop, Calif.; Dr. Guy F. MacLeod, Sunland Industries, Fresno; Dr. Malcolm H. McVickar, California Spray-Chemical Corp., Richmond; Larry M. Roberts, Shell Chemical Corp., San Francisco; James F. Sloan, J. F. Sloan Co., Salinas; and William E. Snyder, Wilbur-Ellis Co., Los Angeles.

Dr. Russell Coleman, executive vice president of the National Plant Food Institute, and Joseph Burger, director of public relations, H. V. Nootbar and Co., Pasadena, will be featured speakers at the convention. Thomas Fleishman, director of western operations, St. Regis Paper Co., San Francisco, is chairman of the convention program committee.

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Is Assistant Sales Manager

R. J. Fosdick has been named assistant sales manager for mixed fertilizers in the southwest by the Smith-Douglass Co., Norfolk, Va. He had managed a sales territory in Cedar Rapids, Iowa, for Smith Douglass. His new headquarters are in Texas City, Texas.

New Fungicides Introduced At Colloquium

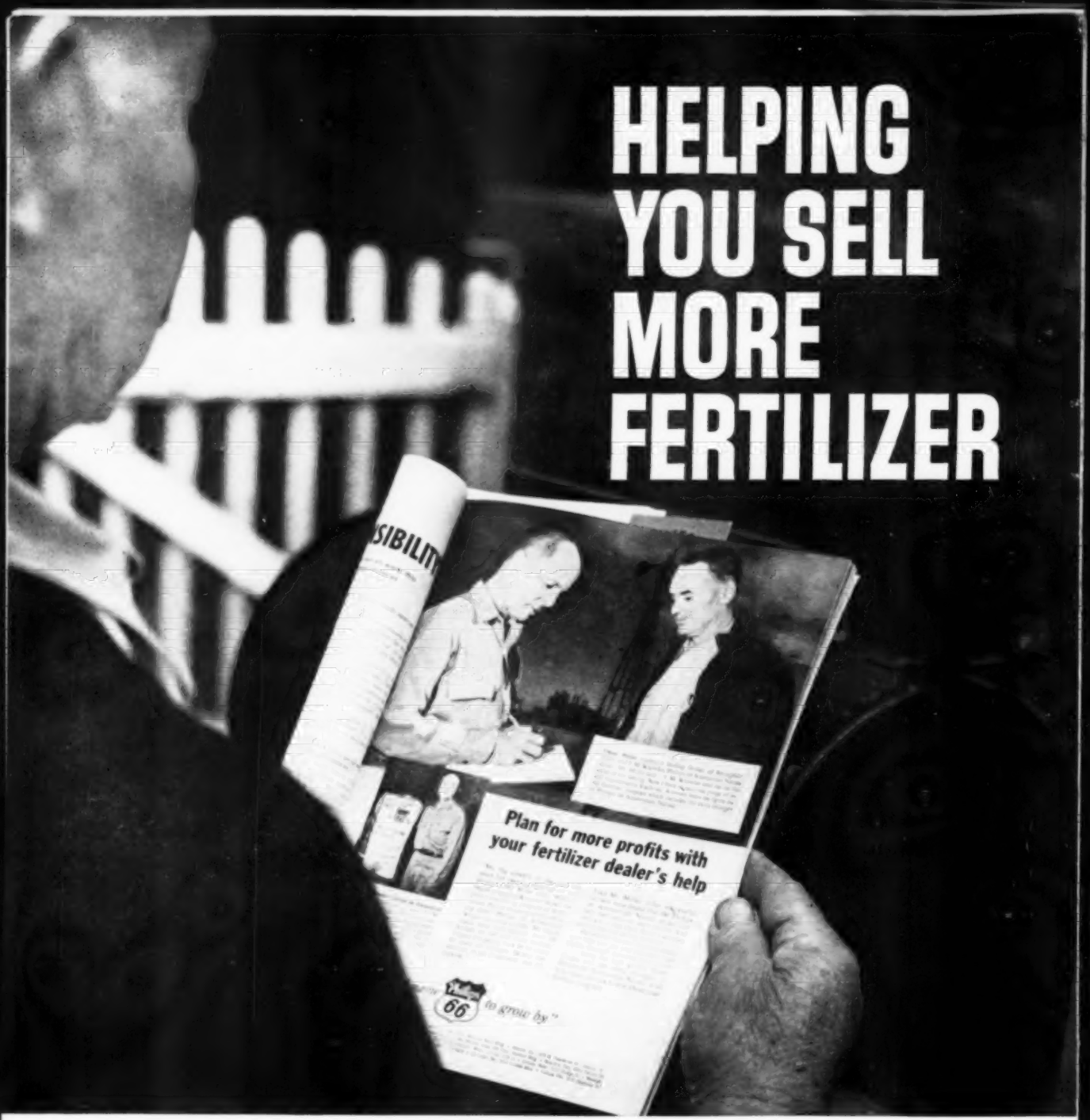
THE annual Fungicide Colloquium was held at Pennsylvania State College, University Park, Pa., August 30 through September 2nd, by the American Phytopathological Society, the APS meeting being held in conjunction with the annual session of the American Institute of Biological Sciences.

Dr. Robert A. Conover, University of Florida, discussed foliar bactericides (antibiotics), reviewing the role they are playing in Florida in the control of vegetable diseases. He indicated that the degree of control being obtained with the antibiotics is not as good as could be desired, and that more work with them, perhaps in combination with copper fungicides, will be necessary before they can be made practical for extensive commercial use.

Dr. Carroll Cox of the University of Maryland reviewed the different theories that are currently accorded acceptance in explanation of the mode of action of fungicides.

Joseph A. Noone of the National Agricultural Chemicals Association commented on the current status of legislation and federal controls which apply to fungicide use. He reviewed the procedure necessary in securing registration of new products under the Miller amendment, and getting residue tolerances cleared with the Food and Drug Administration. He also discussed the effect of the new Food Additives Bill and reported that, in general, fungicides registered under the Federal Insecticide & Fungicide Act will not come under the Food Additives Bill. Nor will nematocides come under this bill, he advised; as a result of the recent amendment of the Insecticide & Fungicide Act, they are now classed as pesticides and come under this control.

A number of new commercial products were described in the Industry Presentation. Dr. G. D. Munger of American Cyanamid Co., New York, reviewed some of the data on Cyprex Dodine–65W, a new fungicide just introduced commercially in 1959. J. S. Skaptason of Chemagro Corp., New York, discussed Dyrene, Bayer 22555 Seed and Soil Fungicide and Chemagro B-1843, a new experimental fungicide just introduced. J. R. McFarland of Miller Chemical & Fertilizer Co., Baltimore, discussed Miller's Copper-Zinc-Chromate Fungicide 658.



PHILLIPS 66

"A good name to grow by"

This farmer is reading a Phillips *66* Ammonium Nitrate ad. Although it advertises the superior qualities of Phillips *66* Ammonium Nitrate, it also emphasizes farmer-dealer planning of a balanced fertilization program . . . and the importance of good soil management through the use of mixed fertilizers as well as supplemental straight nitrogen.

In 1959, most of the Nation's farmers will see these "farmer-dealer-planning" ads in leading magazines like CAPPER'S FARMER, FARM JOURNAL, and FARM AND RANCH.

But then, promoting better farmer-dealer relationship and increased use of mixed fertilizers is just one of the many ways in which Phillips helps fertilizer manufacturers. For example, Phillips will assist in sales meetings for your salesmen and dealers . . . provide skilled technical assistance . . . compute your formulations on its electronic computer . . . and, of course, give you dependable delivery of high quality Nitrogen Solutions, Anhydrous Ammonia, Ammonium Nitrate, Ammonium Sulfate, and Triple Superphosphate.

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Best Straub White

Spencer Management Shifts

Changes in top production and sales management positions in the Agricultural Chemicals Division of the Spencer Chemical Co., Kansas City, Mo., have been announced. They follow the recent election of new Spencer officers which saw John C. Denton become company president.

Among those involved in the recent changes were: Francis E. Best (left), formerly north central district sales manager, now sales manager of the division; Jack E. Straub (center), formerly assistant to the vice president, has become general manager of production; and S. Ray White (right), formerly sales manager, now is general sales manager.

Also named were: W. Dave Van Aken, new north central district manager; and Ralph Willits, midwest district manager.

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Johansen Rejoins Diamond

Douglas G. Johansen has been appointed an agricultural sales serviceman for the Diamond Alkali Co.'s Chicago branch sales office. Formerly a salesman for Diamond Agricultural Chemicals, Mr. Johansen had been employed by another chemical company since July 1958.

From headquarters at Billings, Montana, Mr. Johansen will cover Wyoming, Colorado, Montana, and portions of North Dakota and Nebraska.

•

Named To New Post

H. D. Wellington has been named to the newly-created post of assistant general sales manager for the Gilman Paper Co. and its subsidiaries, St. Marys Kraft Corp. and the Kraft Bag Corp. He had been western sales manager.

•

Chase Bag Moves Offices

The Chase Bag Co. has moved its executive offices to a recently completed, 22-story office building at 355 Lexington Avenue in New York. The Chase offices occupy the entire 13th floor and half of 12.

Conference on Growth Regulators Features Research Developments

THE Fourth International Conference on Plant Growth Regulation was held at the Boyce Thompson Institute for Plant Research, Yonkers, N. Y. August 10 to 14. The Conference was sponsored jointly by the Institute and by the New York Botanical Garden and the Brooklyn Botanic Garden. The program was coordinated with the IXth International Botanical Congress held in Montreal, Canada, August 19 to 29. Financial support for the Conference was furnished by the Rockefeller Foundation, the National Science Foundation and 15 commercial companies.

The conference was attended by 126 invited participants from 17 countries. The first day of the meeting was devoted to naturally-occurring growth substances, the second to the gibberellins, the third to the synthetic auxins, and the fourth to other plant growth substances. In addition to the scheduled reports, time was provided for discussion periods. The papers presented and the remarks made during the discussions will be published in book form by the Iowa State College Press about May, 1960. Copies will be sent to all participants, and will also be available to others at nominal cost.

Previous International Conferences on Growth Regulation have been held at Wye College in 1955, at the University of Wisconsin in 1949, and under the auspices of the League of Nations in Paris in 1937. The present Conference was the first one in which the gibberellins were discussed. The Japanese scientists who did the early work on the gibberellins, T. Hayashi, J. Kato, and Yusuke Sumiki, took part in the Conference as well as P. W. Brian, who first called the attention of the western world to the Japanese work. Evidence showing the probable wide spread occurrence of gibberellin like substances in higher plants was presented by C. A. West.

Among the new advances reported to the Conference was the isolation of a new class of auxins from Maryland Mammoth tobacco by D. G. Crosby (Union Carbide Chemicals Corporation) and A. J. Vlitos (Caroni, Ltd., Trinidad, formerly at the Boyce Thompson Institute). About 10 mg. of active chemicals were isolated from a ton of tobacco leaves and growing tips. One of the chemicals was identified as 1-docosanol, and the other one is a long chain fatty acid not yet fully characterized. Bruce Stowe of Harvard also reported results showing growth promoting activity of long chain aliphatic compounds.

The isolation of a new acid from coconut milk, which gives about one-half the stimulation produced by whole milk in tissue culture was reported by L. H. Weinstein, L. G. Nickell, and W. J. Tulecke. New theories on the relation between structure and auxin activity, as related to the requirements for reaction with necessary binding sites, were discussed in separate papers by K. V. Thimann and J. van Overbeek.

A feature of the Conference was a memorial dinner to the late P. W. Zimmerman, who in collaboration with A. E. Hitchcock was the first to test 2,4-D for its effect on plant growth. A number of other chemicals, now actually used or being investigated the world over, such as indolebutyric acid, 1-naphthleneacetic acid, various substituted benzoic acids and aryloxyacetic acids were first worked with in Zimmerman's laboratory. Mr. Zimmerman was a member of the organizing committee for the Conference, but became ill and died while on a business trip in August, 1958 at the age of 74.

George L. McNew, managing director of the Boyce Thompson Institute, was chairman of the Organizing Committee for the Conference and A. J. Vlitos was secretary and chairman of the Program Committee.

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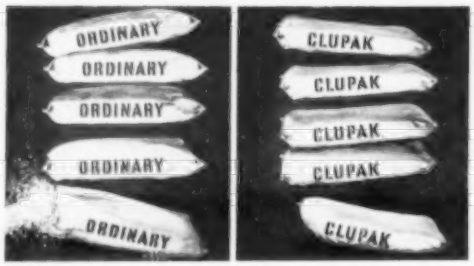
Aluminum sulphate	Perlite
Ammonium nitrate	Pigments
Calcium carbonate	Plant foods
Calcium chlorate	Plaster of Paris
Carbon black	Powdered insecticides
Cement	Pulverized rock
Clays	Polyethylene crystals
Cotton seed meal	Salt
Dehydrated alfalfa	Sand
Feed	Seed
Flour	Soybeans and meal
Fertilizer	Steric acid
Frits	Sugar
Hydrated lime	Sulphate of potash
Meal	Talc
Oyster shells	



DROP TEST comparison demonstrates CLUPAK paper's ability to resist shock. Multiwall sack made with CLUPAK paper (right), survives many more test falls than sack (left) made with ordinary kraft.

ROUGH HANDLING in shipping emphasizes CLUPAK kraft's toughness, ability to stand up where failure often occurs with ordinary multiwalls. Even when new, lighter bag constructions are used, the CLUPAK trademark is your assurance the bag paper meets the most rigid of shipping requirements.

DISCOVERY GIVES PAPER NEW "*TOUGHNESS*" ...MAKES IT ABSORB SHOCKS INSTEAD OF TEARING

BETTER PERFORMANCE, LOWER COST! CLUPAK Extensible Paper opens a new era in paper . . . makes it virtually a new material, with unlimited applications. For CLUPAK paper has built-in *stretch* or extensibility which lets it absorb the shocks and strains that cause ordinary paper to rip, tear and puncture. The result is a new dimension in paper — *toughness*. In multiwall sacks, CLUPAK paper toughness delivers far better performance . . . often at lower cost, by permitting fewer multiwall plies and a net saving in total basis weight. And CLUPAK paper *flexibility* can mean additional advantages — faster filling, easier handling and stacking.

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Hudson Pulp and Paper Corp.
International Paper Co.
St. Lawrence Corp., Ltd. (Canada)
St. Regis Paper Co.
Union Bag-Camp Paper Corp.
West Virginia Pulp and Paper Co.

Vegadex Sales Rise

A sharp reduction in the price of Vegadex, a pre-emergence herbicide for control of annual grasses and certain broadleaf weeds, by its manufacturer, the Monsanto Chemical Co., St. Louis, last August, has resulted in a 4-fold increase in use of the herbicide by Florida vegetable growers, the company reports.

•

Odors For Fertilizers

Dodge & Olcott, Inc., New York, has developed a line of odorants especially designed for the masking and re-scenting of fertilizer products. The are called Fertomasks.

The company has invited fertilizer manufacturers to submit a sample of their products to D&O for the selection of a compatible Fertomask. The treated sample will be returned for the manufacturer's evaluation. A brochure on the new Fertomask line is available from the company at 180 Varick St., New York.

•

Pennsalt Net Up 51%

Pennsalt Chemicals Corp., Philadelphia, has reported six-month net earnings of $2,751,700, an increase of 51 per cent over the 1958 first half. Sales during the period totaled $45,333,400, up 18 per cent from the 1958 figure.

The gain was attributed by William P. Drake, Pennsalt president, to the general improvement in the economy, payout from the substantial investments in new plant and equipment made over the past four years, and a company-wide cost-consciousness.

•

IMC Buys Bartlesville Plant

The International Minerals & Chemical Corp., Skokie, Ill., has purchased a fertilizer plant—formerly owned by Moneka Farm Stores, Inc., but inactive for the past year—in Bartlesville, Okla.

The company plans to modernize the buildings and machinery and to install new equipment for the production of Rainbow, IMC's premium plant food.

Shell Fertilizer Plant In England To Use New Process For Producing Ammonia, Nitric Acid, And End Products

LESSONS learned in the past 25 years in the U. S. have provided great help to the Shell Chemical Company in the design of a new fertilizer plant which has just been opened at Shell Haven in England. The systems of production to be used are the natural development of methods and ideas perfected since the early '30s in producing ammonia at Shell Point, Calif., where the hydrogen required is obtained by the pyrolysis of natural gas.

The Shell group has recently had more experience in this important field with its plant for the production of ammonia, which came into operation at Ventura, Calif., in 1953 and where the principle of using high pressure steam for reforming natural gas is employed and some of this ammonia is now being converted into urea.

The Shell Haven plant will produce 75,000 tons of ammonia a year and will eventually be of immense help in stepping up by 300,000 tons a year the production of nitrogenous fertilizer. Built at a cost of over $18 millions, the new plant will produce ammonia, nitric acid and a variety of fertilizer end products by a process recently developed by Shell, based on fuel oil gasification. This is a partial combustion process operated under pressure and using oxygen or oxygen-enriched air, by which any feedstock ranging from gaseous hydrocarbons to the heaviest fuel oil can be converted into crude synthesis gas, containing a high percentage of hydrogen and carbon monoxide.

Novel features of this process include the efficient recovery of waste heat from the gas by way of high pressure steam generation, and the removal from the synthesis gas of a small quantity of carbon in a form which makes it suitable for further use. The first unit employing this process came into successful operation at Ijmuiden, Holland, in December, 1956.

By the use of this process, Shell Chemical feels it will be possible to ensure that the production of ammonia will be based on the most economical feedstock, regardless of which petroleum fractions are most cheaply available at the refinery from time to time.

The remainder of the ammonia plant will be of more conventional design and will include units for the removal of hydrogen sulphide by the Shell phosphate process, for the shift conversion of carbon monoxide to hydrogen, for the removal of carbon dioxide by the hot potassium carbonate process, for the final purification of the synthesis gas by a wash with liquid nitrogen, and for the synthesis of ammonia.

Some of the ammonia will be further processed to nitric acid. After making a study of the economics of operating under various conditions, it was decided that a plant operating at medium pressure, producing an acid of about 57 per cent concentration, would be the one most suited to Shell Haven conditions.

For the production of "Nitra-Shell", the first step is to produce a highly concentrated slurry of ammonium nitrate by the neutralization of nitric acid with gaseous ammonia. Powdered chalk is then added to the slurry, after which the mixture enters the granulating drums. By maintaining the ratio of ammonium nitrate to chalk at about 59 : 41, the resulting product is really a physical mixture of ammonium nitrate and chalk having a nitrogen content of at least 20.5 per cent by weight.

Apart from the production of "Nitra-Shell", a substantial part of the ammonia to be produced at Shell Haven will be sold to Fisons, Ltd., who have erected a fertilizer plant on an adjacent site at a total capital cost of 12 million dollars.

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It's the one and only ammonium nitrate you can safely store for big spring markup and extra profit! Lion E-2 is free-flowing when you get it... free-flowing when you sell it... no matter how long you store it!

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Order Lion E-2 Now . . . Order Big . . . Cash in Big!

IMC In 3-Year Agreement

The International Minerals & Chemical Corp. has entered into a three-year agreement with Local 613, International Chemical Workers Union, covering the company's phosphate chemicals plant at Bonnie, Fla.

The new contract provides an average basic wage increase of ten cents per hour, with automatic increases of five cents per hour for the second and third years of the new contract, plus an improved vacation schedule.

•

New Union Carbide Division

The Union Carbide Corp., New York, has formed an operating division which will be known as the Union Carbide Consumer Products Co. Initially, it will market the firm's Prestone and Eveready brand products, among which are included garden chemicals. These products had been handled by the National Carbon Co., division of Union Carbide.

Adger S. Johnson, formerly president of National Carbon, has been elected a vice-president of Union Carbide Corp. and will supervise the consumer product activities of the corporation. Arthur C. Bryan has been appointed president of the Union Carbide Consumer Products Co. and William H. Feathers was named president of National Carbon Co.

•

Assumes New Duties

Bernard H. Lorant, recently named as assistant to the president of Velsicol Chemical Corp., Chicago, has been assigned responsibility for the company's over-all research and development activities. He also continues to be in charge of legal and patent functions.

Mr. Lorant joined Velsicol in 1946 and was named assistant to the president last April.

•

Monsanto Research Center

The Monsanto Chemical Co., St. Louis, Mo., plans to develop a research center at its general offices located in Creve Coeur, St. Louis County.

In the initial phase, a building complex occupying about 400,000 square feet of total area will be constructed. The company hopes to have all buildings completed in 1961.

Bunker Hill Selects Site

The Bunker Hill Co., San Francisco, has announced that its new fertilizer plant will be constructed in Kellogg, Idaho, home of the company's mining and major metallurgical operations. Construction is scheduled to start immediately.

Both Kellogg and Kennewick, Wash., had been under consideration as the plant site. The company said that a major reason for selecting Kellogg was that sulfuric acid is available there as a by-product of Bunker Hill's zinc plant.

•

Spencer Sales Program

The Spencer Chemical Co., Kansas City, Mo., is introducing a slogan to launch and identify a new sales promotion program. The slogan is "Don't Just Fertilize, Spencerize".

The new program is aimed at focusing attention on the entire range of nitrogen products made by the company's agricultural chemicals division. The program, Operation Omnibus, will be presented via farm paper, radio, fair displays, and a movie entitled "Fertilizer First". The movie dramatizes contributions made by the company to the fertilizer industry since it began commercial operation in 1946.

•

Dow Appoints Two

Two staff appointments in the agricultural chemicals development unit of the Dow Chemical Co., Midland, Mich., have been announced. Robert M. Ioset is in charge of work on the animal health product line and Paul M. Ritty has been named to head industrial vegetation control projects.

•

Rule Out Heat Vaporizers

In Kansas, under a Board of Health ruling, the sale, offering for sale, or holding for sale, of any device intended for household use which is designed or intended to vaporize by heat any chlorinated hydrocarbon insecticide is prohibited.

Pesticide Damage To Plants Reported In Washington Tests

E. C. Klostermeyer and C. B. Skotland, asso. entomologist and assistant plant pathologist, respectively, for the Agricultural Experiment Stations of the State College of Washington, have issued a progress report on studies being conducted on the effect of heptachlor on hops in the Yakima Valley.

The studies indicate that when baby hop plants are planted in heptachlor treated soil, or when hops are replanted in an old, treated yard, the slips cannot establish a root system and the plant dies. When long established hop yards are treated with heptachlor, the plants are not killed outright but can persist for some time. The plant eventually dies, however, owing to destruction of the root tissue, the preliminary report points out.

Symptoms of pesticide damage to hops include a roughening of the bark, which cracks so that large amounts of sap flow from the vine. The base of the affected vine often is swollen below ground and tapers to a small diameter at the attachment to the crown. In the crown and roots, the symptoms of pesticide injury often are not distinctive from rots induced by such factors as downy mildew and other fungi.

Although studies are continuing, all recommendations for the use of heptachlor as a soil treatment or in other ways that might result in an accumulation of heptachlor in amounts which might be toxic to hops have been deleted from State College of Washington recommendations for insect control. In addition, Federal registration for the use of heptachlor on hops has been withdrawn.

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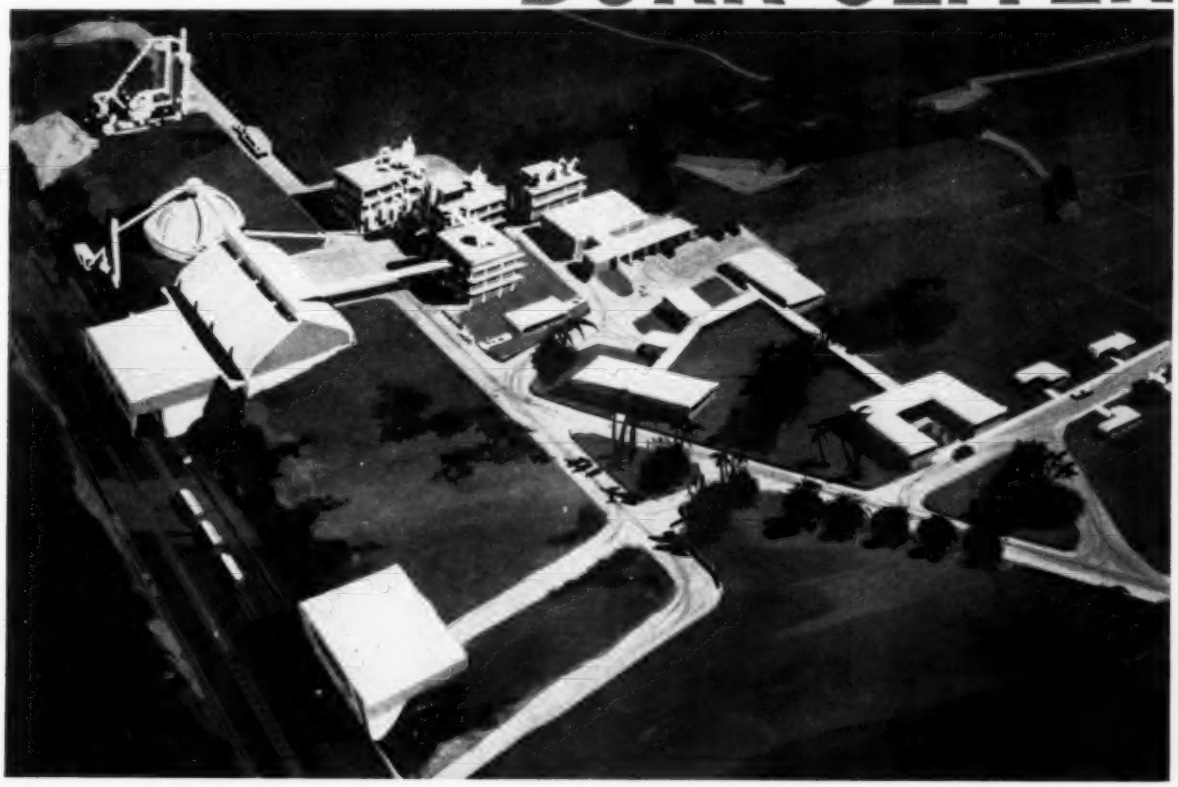

Mexico's first Triple Superphosphate plant

Designed to produce 150 metric tons per day of granular fertilizer, the plant sketched above is part of a Mexican government program to promote agriculture and increase industrial independence. It will be the latest of several chemical and fertilizer operations of Guanos y Fertilizantes de Mexico, S. A., and the first Mexican plant producing triple superphosphates. Start-up is scheduled for 1960.

Like so many of the most modern fertilizer plants erected throughout the world, this new venture will employ the Dorrco Granular Fertilizer and Dorrco Strong Phosphoric Acid Processes. Plant design, engineering and equipment for these processes are being supplied by Dorr-Oliver Inc. The contract with Dorr-Oliver also calls for design, engineering and supply of equipment for the unloading and storage of raw materials, shipping, power production, warehouse and laboratory facilities, and for offices and other buildings.

The services of Dorr-Oliver cover all phases of fertilizer plant design, from laboratory studies and economic evaluation to supplying a complete operating facility of any size. Write for a copy of Bulletin No. 8000 – or let us send an engineer to discuss your particular project. No obligation, of course.

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European Representative

Barnard & Leas Mfg. Co., Cedar Rapids, Iowa, has appointed Euram S.A., 10 Place de la Gare, Lausanne, Switzerland, as its exclusive sales representative for Western Europe.

Euram S.A. handles the sale of B&L Mobile Formula Feed Blender, B & L Skid Mounted Formula Feed Blender, and the liquid fertilizer processing equipment manufactured by the Chemical Plants Division of Barnard & Leas.

•

Kenneth A. Keith Dies

Kenneth A. Keith, an employee of the Spencer Chemical Co. for the past 12 years, died suddenly last month. He was 43.

Associated with Spencer's agricultural sales and market research activities since 1947, Mr. Keith was preparing to move to Omaha where he was to manage a new district sales office for the company.

•

St. Regis Subsidiary

The St. Regis Paper Co., New York, has announced that the Chemical Packaging Corp., which it recently acquired through an exchange of stock, will be operated as a subsidiary specializing in the sale of multiwall bags and packaging equipment to the fertilizer industry east of the Mississippi River.

Richard Heard, president of Chemical Packaging, will continue in that capacity and will work directly with Bernard W. Recknagel, vice president and general manager of the St. Regis Flexible Packaging Products Sales Division.

•

Named To Marketing Staff

The International Minerals & Chemical Corp., Skokie, Ill., has appointed Richard L. Chambless as a marketing staff assistant in its Plant Food Division. He had been a sales representative in Tupelo, Miss., for the division.

•

Spain Gets Fertilizer Loans

Two Spanish chemical groups have received $17.6 million in credits from the Export-Import Bank to buy U. S. equipment for fertilizer projects.

Refineria de Petroleos de Escambreras, SA, has received a $10 million credit. Abonos Sevilla, SA, has received $7.6 million. Both are established Spanish chemical producers.

Georgia Fertilizer Study Reveals Changes In Farm Practices

P. J. Bergeaux, agronomist with the Agricultural Extension Service, University of Georgia College of Agriculture, Athens, Ga., has conducted a survey on amounts per acre of fertilizer nutrients used by farmers on the major crops grown in Georgia.

Since World War II and particularly in recent years, his report reveals, Georgia's agriculture has changed rapidly. Acreage controls and other government programs have drastically reduced the acres planted to cotton and tobacco. This plus other factors, has resulted in a shift from primarily a row crop economy to one combining row crops and livestock.

Expanding interest in livestock farming has led to an increase in improved pasture acreage, and the need for high quality forage has resulted in increased pasture fertilization, Mr. Bergeaux's report explains. Corn, previously considered a necessary evil, has emerged as an important cash crop.

This readjustment of Georgia's agriculture is reflected in the changing pattern of fertilizer use by crops. Cotton and tobacco, for instance, accounted for only 11.7 per cent of the total amount of fertilizer nutrients used by farmers in 1958. On the other hand, approximately 77 per cent of the total fertilizer nutrients used by Georgia farmers were applied to corn and pastures.

Of interest to the Georgia fertilizer industry is the extension of the fertilizer season brought about by the increased use of fertilizer on pastures. This has meant a more even distribution of fertilizer sales throughout the calendar year, the report said.

Plant Disease Short Course

A Plant Disease Short Course will be held Nov. 23 and 24 at Texas A. & M. College, College Station, Texas. The first such course to be presented by the school's Department of Plant Physiology and Pathology, it is intended mainly for representaitves of agricultural chemical companies. However, it should be of interest to plant pest control operators, nurserymen, and others.

The discussions will cover cotton diseases, vegetable diseases, ornamental diseases, and plant parasitic nematodes.

•

Accident Prevention School

A school on accident prevention for fertilizer plant personnel will be held Oct. 29 and 30 at Fresno, Calif. The school is sponsored by the Fertilizer Section of the National Safety Council in cooperation with the National Plant Food Institute.

•

Dedicate Phosphate Plant

The Central Farmers Fertilizer Co. last month dedicated its $16 million phosphate plant at Georgetown, Idaho, in ceremonies that were attended by leaders in business and government as well as officials of west and midwest farm organizations.

The plant is the only such facility of its kind in the United States, outside of the Tennessee Valley Authority, to use elemental phosphorus in the production of high-analysis superphosphates for agricultural application.

•

Heads Detroit Sales

Walter J. Kilmer has been made manager of the Detroit sales division of the U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., New York. He succeeds Fred M. Henley, who is retiring after 36 years with the company.

Mr. Kilmer has been with U.S.I. for approximately 25 years. Prior to his present assignment he had been a sales representative for the company at Buffalo, N. Y.

Britton Joins U. S. Potash

The United States Borax & Chemical Corp., Los Angeles, Calif., has appointed James C. Britton as agronomist in the plant food development department of its United States Potash Co. division. Mr. Britton is located at West Lafayette, Ind.

•

Allied District Agronomists

Rein U. Mesdag and Dr. E. Peter Griffin have been appointed district agronomists for the Nitrogen Division of the Allied Chemical Corp., New York. Mr. Mesdag will serve 11 Midwestern states from his headquarters in Omaha, Nebr.

Dr. Griffin, whose headquarters are at Westerville, Ohio, will cover the remaining eastern half of the Midwest.

•

Maleic Anhydride Plant

The West's first plant for the manufacture of maleic anhydride will be built at Richmond, Calif., by the California Chemical Co., a subsidiary of the Standard Oil Co. of Calif.

The plant will have a capacity of 20,000,000 pounds of the chemical annually. California Chemical's industrial chemical subsidiary, Oronite Chemical Co., will market the plant's output.

•

Technical Services Engineer

Dr. Ingmar Sollin, senior research chemist in the research, engineering, and development division of the International Minerals & Chemical Corp., Skokie, Ill., has been appointed to the company's industrial chemicals department as a technical services engineer.

•

U. S. Borax Names Weinig

The United States Borax & Chemical Corp., Los Angeles, has appointed Arthur J. Weinig Jr. as assistant chief engineer at the company's potash operations in Carlsbad, N. Mexico.

Formerly general manager for the New Mexico Thorium Corp. at Carlsbad, Mr. Weinig also served with the Potash Company of America for 18 years and was associated with the Farm Chemical Resources Development Committee.

•

Northeastern Sales Manager

The Dow Chemical Co., Midland, Mich., has named John H. Wallberg as manager of agricultural chemicals sales for the northeastern states. His headquarters are in New York. Mr. Wallberg joined Dow in 1946.

Hercules To Show Penton

Penton, a new corrosion-resistant plastic, will be featured in the Hercules Powder Co.'s exhibit at the 27th Exposition of Chemical Industries in New York's Coliseum, Nov. 30 to Dec. 4.

Developed by Hercules, this chlorinated polyether plastic is finding uses in anticorrosive equipment, such as injection-molded valves, fittings and pump parts, pipe, flow meters and meter parts, and as a coating for metal.

Insect Vapor Barrier

A U. S. patent, number 2,899,771, recently was granted to Alonzo A. Burris Jr. of Mount Pleasant, S. C., for an insect resistant vapor barrier that can be placed under a building during its construction.

A relatively thin vapor barrier that extends beneath the basement floor of a building from wall to wall is faced on the ground side by a water soluble carrier capable of retaining an effective quantity of insecticide and releasing it on exposure to moisture. Since the carrier faces the ground, it is fully exposed to contact by moisture and the insecticide that is released acts to resist the entry of insects into the building.

•

Summers Acquires Chemgro

The Summers Fertilizer Co., Baltimore, has purchased the plant, equipment, inventory and trade mark of Chemgro, Inc., Fergus Falls, Minn.

Chemgro manufactures fertilizers. Its equipment is built around a TVA continuous ammoniating unit with an annual capacity of 15,000 tons. It will be designated as the Chemgro Division of Summers.

•

Pesticide Toxicity Values

The format of the chart in the article on "Relative Toxicity to Mammals", by S. H. Kerr and J. E. Brogdon, appearing on pages 11 and 45 of the September issue was changed by *Agricultural Chemicals* from the original manuscript. The authors feel this may have given an inaccurate interpretation to some of the figures in the chart. Particularly, since a general heading of "Acute LD_{50}" was used, and not all the data in this column was Acute LD_{50}. The figures were toxicity values expressed in Mg./Kg. In addition, there were some omissions.

Copies of the table in the original format are available from the authors at the State of Florida Extension Service, University of Florida, Gainesville, Fla.

MEETING CALENDAR

Oct. 7-8 — Industry Symposium, "Research Progress on Insect Resistance", Hotel Mayflower, Washington, D. C.

Oct. 13-14 — Western Agricultural Chemicals Assn., fall meeting, Villa Hotel, San Mateo, Calif.

Oct. 12-14 — Association of Official Agricultural Chemists, annual meeting, Shoreham Hotel, Washington, D. C.

Oct. 14-16—Pacific Northwest Plant Food Assn., annual convention, Chinook Hotel, Yakima, Wash.

Oct. 15-16—Chemical Control Conference and Fertilizer Control Officials Meeting, Shoreham Hotel, Washington, D. C.

Oct. 19-20 — Weed and Nematode Forum, Sponsored by Spencer Chemical Co., Kansas City, Mo.

Oct. 19-20—Fertilizer Safety Section, National Safety Conference, LaSalle Hotel, Chicago.

Oct. 21-23—National Agricultural Chemicals Association, 26th Annual Meeting, French Lick-Sheraton Hotel, French Lick, Indiana.

Oct. 27-29—Florida State Horticultural Society, Everglades Hotel, Miami, Fla.

Oct. 29-30 — Eastern Branch, Entomological Society of America, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

Nov. 2-4—Canadian Manufacturers of Chemical Specialties, second annual meeting, Royal York Hotel, Toronto, Canada.

Nov. 4-6—Fertilizer Industry Round Table, Mayflower Hotel, Washington, D. C.

Nov. 9 — South Carolina Plant Food Educational Society, Clemson House, Clemson, S. C.

Nov. 8-10—National Fertilizer Solutions Assn., annual convention, Statler Hilton Hotel, St. Louis, Mo.

Nov. 9-11 — California Fertilizer Assn., 36th Annual Convention, Fairmont Hotel, San Francisco.

Nov. 12-15—Texas Aerial Applicators Association, Orange House, Orange, Texas.

Nov. 16-20 — National Aviation Trades Assn., 20th Annual Convention, Hotel Monteleone, New Orleans, La.

Nov. 30-Dec. 2 — Carolinas-Virginia Pesticide Formulators Assn, Carolina Hotel, Pinehurst, N. C.

Nov. 30-Dec. 3—Joint meeting of Entomological Society of Canada and Entomological Society of America, Detroit, Mich.

Nov. 30-Dec. 2 — Soil & Crop Science Soc. of Florida, Gainesville, Fla.

Dec. 7-9 — 46th annual meeting, Chemical Specialties Manufacturers Assn., Mayflower Hotel, Washington, D. C.

Dec. 7-10—Western Canadian and North Central Weed Control Conferences, Royal Alexandra Hotel, Winnipeg, Manitoba, Canada.

Dec. 9-11 — International Crop Protection and Pest Control Exhibition, Seymour Hall, St. Marleybone, London, England.

Jan. 6-8—Northeastern Weed Control Conf., 14th annual meeting, Hotel New Yorker, New York.

Jan. 14-16 — California Agricultural Aircraft Association, 10th Annual Convention, El Mirador Hotel, Palm Springs, Calif.

Jan. 13-15 — Agricultural Ammonia Institute, 9th Annual Convention, Statler-Hilton Hotel, Dallas, Tex.

Jan. 20-21 — Northwest Agricultural Chemicals Industry Conf., Benson Hotel, Portland, Ore.

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Equipment, Supplies, Bulletins

Automatic Dispenser Features Fairfield Pyrenone Insecticide

The Syncro-Mist Automatic Dispenser, a move towards automation in insect control on the farm, in industry, and in the home, releases measured amounts of Pyrenone insecticide spray every 15 minutes. The device controls flying insects in a 6,000 cubic foot area 24 hours a day.

The automatic dispenser is a development of Syncro-Mist Controls, Inc., New York, in cooperation with Fairfield Chemicals, Food Machinery & Chemical Corp., New York, producer of the insecticide concentrate used in the machine.

Housed in a steel case, the unit's electrically-operated internal timing mechanism actuates a container of pressurized insecticide, releasing a measured amount of spray every 15 minutes.

Roto-Guard Motion Indicator

The Bin-Dicator Co., Detroit, is making available a new motion indicator that is a means of converting motion of various types into a signal impulse which may, in turn, be used to energize an alarm system. It is intended to prevent damage.

The device, Roto-Guard motion indicator, is connected to any slow turning shaft. As long as the shaft rotates normally, the Roto-Guard indicates normal operation. Should the rotation of the shaft slow below operating level, the alarm signal warns the operator who then can take the necessary steps to prevent damage to other machinery in the system. Roto-Guard also can be wired into an interlock system.

•

High-Lift Drum Handlers

Powered high-lift models have been added to the line of all purpose drum handlers offered by the Specialty Machinery Corp., Newark, N. J. The high-lift models employ a telescoping mast which permits a low, close height for easy maneuvering ability.

The new units, which will pick up a drum from either a horizontal or vertical position, will elevate up to 800 pounds to a height of eight feet.

•

National Sticker Bulletin

The Holloway Corp., Maspeth, N. Y. is offering a bulletin that describes National Sticker, a product that is said to greatly increase the retention qualities of ordinary insecticide water spray mixtures.

The booklet contains descriptions and results of laboratory and field tests of the product, together with statements as to quality and efficiency of National Sticker. It is available from the company at 57-02 48th St., Maspeth 78.

•

House Plant Care Device

Taffel Bros., Inc., a sales promotional organization at 347 Fifth Ave., New York, is offering a handy, plant care dial that provides information on the proper care of a wide variety of houseplants and cut flowers.

•

Dry Processing Equipment

An eight-page color catalog, illustrating and describing the Sturtevant Mill Co.'s full line of dry processing equipment now is available from the company at Park and Clayton Sts., Boston 22, Mass.

•

Entoleter Control Mill

The Entoleter Division of Safety Industries, Inc., New Haven, Conn., has published a four-page, illustrated folder on its Contro Mil, a contrarotating centrifugal impact mill.

The double-rotor action, of the mill, combined with the use of lower rotational speeds to achieve higher impact velocities, is said to reduce operating and maintenance costs substantially.

Dual Head Sewing Stand

A dual head sewing stand, designed for use in closing open-mouth multiwall bags, is being offered by the Union Bag-Camp Paper Corp., New York. This latest addition to the Union I&C packaging machinery line accommodates either the 80600E or the 80600H sewing head.

The new machine is designed to solve the problems arising from thread breakage. With it, if one sewing head breaks down, the other head easily can be swung into place without any loss of production.

•

Export Products List

The Hooker Chemical Corp.'s export sales office, New York, has prepared an alphabetical list of Hooker export products that includes physical data, uses, and shipping containers for each product.

New Hough Tractor Shovel

The Frank G. Hough Co., Libertyville, Ill., has developed a new four-wheel-drive, rubber-tired tractor shovel with 5,000 pounds carrying capacity. The new loader, Model H-50, already is in production and is scheduled to replace the Model HU "Payloader."

Features of the H-50 include more power available for both hydraulics and traction, more efficient torque-converter, and complete power-shift transmission. Literature and specifications on the new unit are available.

•

Caustic Potash Booklet

The Solvay Process Division of the Allied Chemical Corp., New York, has prepared a 63-page bulletin on the properties of caustic potash and its solutions. The bulletin also describes the handling and dissolving of caustic potash and caustic potash liquor.

Masking Chemical Odors

P. Robertet & Cie of Grasse, France, has developed what are said to be practical, long-lasting, and completely effective masking agents for insecticides and fertilizers.

In addition to effectively masking chemical odors, the new products add their own fragrance to a chemical. For manufacturers who would like to conduct their own tests, free samples are available from the New York office of P. Robertet, Inc., 221 Fourth Ave., New York 3. P. Robertet has been engaged in the manufacture of perfume raw materials for over 100 years.

•

Heckathorn Tolerance Folder

United-Heckathorn, Richmond, Calif., is offering a wallet-size folder that lists the tolerances of almost 40 agricultural chemicals and gives limitations of days prior to harvest for the various crops on which each is used.

Copies of the folder may be obtained from the company at 600 South 4th Street, Richmond.

•

Richardson Scale Bulletin

The Richardson Scale Co., Clifton, N. J., is offering a six-page bulletin describing the Richardson GA-38 bagging scale, an automatic machine designed for high-speed loading of 25, 50, and 100-pound bags.

Photographs show the GA-38 close up and in operation in an actual installation. Drawings are used to illustrate details of construction and dimensions.

•

CSC Custom Production

The Commercial Solvents Corp., New York, has prepared a brochure to describe its biochemical and chemical facilities available for custom production.

Among the processes available and described in the brochure are condensation, esterification, fermentation, hydrogenation, hydrolysis, nitration, oxidation, and reduction.

BREVITIES

THE PHILLIPS PETROLEUM CO., Bartlesville, Okla., has announced a patent licensing agreement under which the McLaughlin Gormley King Co., Minneapolis, Minn., will conduct the sales development and marketing of five insect repellent chemicals discovered by Phillips.

AC

GEORGE G. MADGWICK has joined the development department of the Union Carbide Chemicals Co., division of Union Carbide Corp., South Charleston, W. Va. He had been associated with the National Research Council of Canada.

AC

HARRIS LABORATORIES, INC., Lincoln, Nebr., has acquired the equipment and facilities of Soil Consultants Bureau, Kansas City Testing Laboratories, of Kansas City, Mo. Harris plans to increase its research studies of insecticide, herbicide, and fungicide field trials, fertilizer formulation, and feed additive development.

AC

A. F. VETTER, former production superintendent at the American Agricultural Chemical Co.'s Washington C. H., Ohio, plant, has been named division maintenance superintendent for the company's Northeastern Division.

AC

HEISLER'S Inc., Willard, Ohio, has been appointed a distributor for the Highway Equipment Co., Cedar Rapids, Iowa. They will handle lime spreaders, combination lime and fertilizer spreaders, and mobile blenders in seven Ohio counties.

AC

THE VIRGINIA-CAROLINA CHEMICAL CORP., Richmond, Va., last month sent eight members of its fertilizer sales organization and their wives to Bermuda for an expense-paid week's vacation. The eight were winners in a company sales contest.

J. PAUL EKBERG JR. has been appointed product director of agricultural chemicals for the Organic Chemicals Division of the Monsanto Chemical Co., St. Louis, Mo. He had been assistant director of sales.

AC

EUGENE G. WARD has been appointed to the Crag Agricultural Chemicals sales staff by the Union Carbide Chemicals Co., Division of the Union Carbide Corp., New York.

FOLIAGE FEEDING

(*From Page* 68)

"(2) Many more foliar applications are needed per season than with soil treatment. One or two foliar applications are not enough to supply the tree's nitrogen needs for the entire season. Most trees will require four or five applications, starting after the leaves emerge in spring and repeating every two weeks. Trees which get some nitrogen from the soil, however, would require only two foliar applications.

"With minor elements like iron and boron, of which only traces are needed for normal growth, a single application in early spring may supply the tree's needs for the season.

"(3) There is more danger of burning from foliage sprays than with soil applications. This is true when the sprays are not diluted according to the manufacturer's directions. Urea, the prime source of nitrogen in most foliage spray preparations, may cause some leaf burn when the carbohydrate content of plants is low. The soil has a high buffering capacity and hence one can apply more than the recommended amounts of dry fertilizers to soil without harming the plant.

"(4) Foliage nutrients are expensive. Part of this is due to the use of instantly soluble salts which are far more expensive than those used in standard soil fertilizers. Their cost is not prohibitive when one considers the excellent results obtained as well as the lower cost of application, as compared to soil treatment. The latter is especially true when the nutrients are included with the pest control sprays."

ACS MEETING

(*From Page* 40)

field. Standardization of reagents and procedures, he feels, should be a major objective and will do much to improve both the quantity and quality of the work conducted.

Dieldrin Retention

EXPERIMENTS on dieldrin retention in farm animals were reviewed by Norman Gannon of the Illinois Natural History Survey. Fed to various animals for 12 weeks at levels of .1 .25, 175 and 2.25 ppm, dieldrin was detectable in the fat of all animals fed on the various levels of dieldrin intake. Steers stored more dieldrin in their tissues in terms of parts per million than did hogs, while lambs stored least. The amount of dieldrin stored appeared to be proportioned to intake. When fed to dairy cows, in the same proportions, tissue analyses indicated that dieldrin was present in fats at a concentration of approximately 5 ppm as a result of feeding the highest dosage.

Spraying Pesticides on Livestock

H. V. Claborn, USDA, ARS, presented a paper on "Meat and Milk Contamination Resulting from Spray Applications of Pesticides to Livestock," prepared by himself, R. D. Radeleff, R. C. Bushland, H. D. Mann and M. C. Ivey. He reported, "Chlorinated hydrocarbons and some of the phosphorus insecticides are fat-soluble and when sprayed on cattle or sheep for control of livestock pests may be absorbed through the skin and stored in the fatty tissues, and they may be excreted in the milk of lactating dairy cows. Before an insecticide can be recommended for use on livestock, studies must be made to determine whether or not the dosages used will lead to meat and milk contamination.

"Such studies have been conducted at the Kerrville, Tex., laboratory during the last ten years through the cooperation of entomologists, veterinarians, and chemists of the Agricultural Research Service.

"Studies on milk contamination have been made on DDT, TDE, Methoxychlor, perthane, dilan, dieldrin, toxaphene, strobane, strobane, lindane, Malathion, and Bayer 21/199.

Studies on the storage of insecticides in fat resulting from single or multiple spray treatments on beef cattle include DDT, TDE, methoxychlor, lindane, dieldrin, heptachlor, chlordane, gammachlordan, Strobane, toxaphene, malathion, Bayer 21/199, and delnav. Samples of omentum fat were taken for analysis by a biopsy technique at two or three weeks after treatment, and at other intervals as appeared necessary to determine the duration of contamination."

Contamination of Water Supply

ANOTHER symposium at the meeting before the Division of Water, Sewage and Sanitation Chemistry, dealt with the subject of contamination of the nation's water supply through organic wastes. F. M. Middleton, of the Robert A. Taft Engineering Center, Cincinnati, who presided at the symposium, observed that the nation's water resources are receiving an increasing quantity of organic contaminants. While most of this contamination results from the discharge of domestic and industrial wastes, some of the problem is due to runoff, either of natural chemical materials or agricultural chemicals such as insecticides, herbicides, etc. New techniques are needed to isolate and identify such contaminants, he said, and more future use will need to be made of odor determining techniques in water pollution studies.

In a paper presented by Mr. Middleton, with J. J. Lichtenberg of the Taft Center as co-author, a procedure was described for determining organic contaminants in water based on adsorption on activated carbon, followed by elution with chloroform and alcohol.

Some chemicals which have been found in the nation's rivers include: Orthonitrochlorobenzene, a by-product from a chemical manufacturing process which was found in a large river where it persisted for one thousand miles; DDT which was found in the Missouri River, Mississippi River, Columbia River, and the Detroit River. The concentrations ranged from 5 to 20 p.p.b. The insecticide aldrin has been found in the Snake River. A significant factor is that such contaminants pass ordinary water treatment processes and show up in the drinking water.

By measuring such contaminants on a continuous basis data obtained will provide important clues as to over-all quality of the nation's water and will give early warning of possible deteriorating conditions, permitting corrective action if required.★★

FLORIDA SOCIETY

(*From Page* 36)

of heptachlor and ¼ pound of parathion per 100 gallons of spray.

A newly enacted Florida Structural Pest Law, which becomes effective October 1, 1959, was explained by F. Robert DuChanois from the Florida State Board of Health.

The new law specifically defines structures as including trucks, trailers, rail cars and boats, and gives the Board of Health additional powers of enforcement. It also changes license fees from $25 to $5, but adds an annual renewal fee of $25. The law prohibits any county or city from issuing a license unless one has been secured from the state.

License requirement are three years as a service employee in the industry (one year of which must be in Florida), a degree in entomology from a recognized college or university, plus six months practical experience, and a satisfactory grade on a written examination to determine the applicant's knowledge of practical and scientific facts pertaining to structural pest control.

Retiring president William P. Hunter urged entomologists to use creative imagination to help advance the science of entomology. He said "Within the next hundred years, all classes of entomologists will face challenges that were undreamed of several years ago. It is extremely probable that some of our young entomologists will face problems brought about by the shrinking globe which do not now exist. In order to master these future problems which may include insects and pests from far off worlds — from the age of space travel—we must have well-trained and hard-working entomologists who are able to do creative thinking."★★

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Wilson & Geo. Meyer & Co. has named Theodore I. Stone vice-president and treasurer.

LISTENING POST

(*From Page 75*)

locality the experiments included six treatments in a randomized block design replicated five times. Instead of new boxes, tray-pack cardboard liners were used. Paste sulfur was included and glyodin was omitted; otherwise the same chemicals at the same concentrations as in the 1958 apple experiments were used for treating the boxes. Pickers followed commercial practice in putting fruit into the treated boxes. At the packing shed, a sub-sample of 20 peaches showing no evidence of rot or other defect was taken from top to bottom along the side of each harvested box. New cardboard trays used commonly for tray-packing apples were filled with this selected fruit, then placed in refrigerated storage overnight for cooling to about 40 F. For the rest of the experiment the fruit was kept at room temperatures in the laboratory. By this procedure the peaches were subjected to conditions similar to those undergone in the ordinary progress from harvest to consumer, although they were given gentler handling than usual. Decaying and sound fruits were counted at 4, 8, and 12 days after harvest.

Table 1. The percentage of apple fruits rotted after 2½ months of refrigerated storage in field boxes sprayed with various chemicals, 1957.

Box treatment	Percent Rot[a]	
	Red Delicious	Golden Delicious
Mercuric chloride AC[b]	7.4**	1.7**
Cycloheximide AC	4.9**	1.1**
Copper sulfate AC	4.3**	3.1**
Captan AC	5.1**	1.3**
Glyodin AC	3.0**	3.0**
Maneb AC	7.5**	1.4**
Zineb AC	3.2**	2.9**
Check AC	14.5	7.8
Check NC	15.7	5.2

[a]Based on observations made on 7,110 fruits.
[b]AC-Boxes artificially contaminated with spores before being sprayed with chemicals. NC-Boxes naturally contaminated.
**Significantly less than the check treatments at 1 percent level. According to analysis of variance applied to the angles corresponding to the percentage.

Table 2. The percentage of apple fruits rotted after 2½ months of refrigerated storage in field boxes treated by spraying or dipping in various chemicals, 1958.

Box treatment	Percent Rot[a]			
	Rome Beauty		Stayman Winesap	
	Sprayed	Dipped	Sprayed	Dipped
Captan 2 lb./100 gal.	2.6**	1.2**	11.2	8.3**
Zineb 2 lb./100 gal.	1.7**	7.1	7.3**	3.3**
Amobam 1 qt./100 gal.	5.3*	1.4**	5.1**	3.3**
Glyodin 1 qt./100 gal.	2.8**	3.9	5.4**	4.5**
New boxes, unsprayed	3.9**	—	6.4**	—
Used boxes, unsprayed	7.5	6.1	12.1	14.0

[a]Based on observations made on 11,187 fruits.
*Significantly less than check treatment at 5 percent level, according to analysis of variance applied to the angles corresponding to the percentage.
**Significantly less than check treatment at 1 percent level.

Results

Apples: The 1957 results on Red Delicious show that the checks in naturally contaminated (no added inoculum) boxes have as much rot as check fruit in artificially contaminated boxes. With Golden Delicious, however, more rot occurred

Table 3. The percentage of post-harvest rots in Hale Haven peaches harvested in field boxes sprayed with different spray chemicals, 1958.

Box treatment	Percent Rot[a] at two locations					
	Romney			Kearneysville		
	Days after harvest			Days after harvest		
	4	8	12	4	8	12
Captan	1.0*	1.0*	12.1*	4.8**	23.0*	44.9**
Zineb	0.3**	0.5*	3.6**	14.3	28.2	46.6*
Sulfur[b]	0.3**	2.9*	6.9**	24.0	31.8	46.6*
Amobam	1.0*	4.1*	7.8**	19.1	38.5	50.9*
Cardboard liner[c]	0.0**	0.3*	1.0**	1.2**	5.6**	14.8**
Untreated	7.7	17.8	44.9	25.8	47.0	74.8

[a]Based on observations made on 1,200 fruits.
[b]Five pounds actual sulfur in 100 gallons water. For dosage in other treatments see Table 2.
[c]"Egg-Shell" liners commonly used for tray packing apples.
*Significantly less than check treatment at 5 percent level, according to analysis of variance applied to the angles corresponding to the percentage.
**Significantly less than check treatment at 1 percent level.

in the artificially contaminated than in the naturally contaminated check. Decay was generally less in Golden Delicious than in Red Delicious boxes. With both varieties all fungicidal treatments proved to be significantly better than the checks.

Captan, whether used as spray or dip, was not very effective with Stayman Winesap, and the zineb dip did not give good results with Rome Beauty. Otherwise results were generally similar to those of the 1957 experiment with Red Delicious and Golden Delicious.

Peaches: At Kearneysville untreated boxes carried a higher load of inoculum and incipient infection of the fruit at harvest was greater than at Romney. The experiments demonstrated that incidence of post-harvest rot in peaches could be greatly reduced by treating the field boxes with fungicides. Tests also showed that cardboard liners gave even better control than chemical treatment of the boxes.

Discussion

ACCORDING to the authors, their rather limited experiments indicate the possibility of major savings to be obtained from chemical treatment of field boxes, to the benefit of commercial growers, dealers, and processors who store apples or handle peaches. The cost of materials for treating the boxes, 25 cents for 100 boxes, is negligible when compared with value of the fruit saved. In each 100 boxes, at a valuation of 2 dollars per box, fruit worth from 10 to 40 dollars could be saved, on the basis of these studies. The authors think it likely that better methods of treating boxes can be devised; also perhaps other chemicals might be just as good as or even more effective than the rather small number tried.

The experiments demonstrated in a very convincing manner that contaminated field boxes constitute an important source of inoculum for infection of harvested apples and peaches by rot fungi. With peaches hardly any other interpretation of the test results is possible, according to the authors. For apples, however, the authors consider that the results reported in the tests may require further explanation. They suggest that the amount of rot shown as occurring in the new unsprayed boxes might result from a heavy load of pathogenic inoculum already present on the fruits when they were picked. Partial or complete failure of some of the chemicals to control rot might also be explained by differences in either or both quantity of spore load and kind of pathogen on the fruits. The authors conclude that, nevertheless, handling during harvest is important in the development of post-harvest rots, and that the use of chemical controls should produce immediate practical benefits.★★

CONTROL LABORATORY

(*From Page* 55)

Citrate-Insoluble Phosphate

Citrate-insoluble phosphate is determined by first leaching the dry sample with water to measured volume, and taking the residue from this leaching, and transferring it to a flask, which contains a volume of neutral ammonium citrate solution at 65°C. The solution containing the residue is then agitated for one hour, filtered by suction, washed with hot water, and digested with aqua regia. From this point, the procedure is the same as that used in the total phosphate determination.

Equipment required includes a constant temperature and constant agitation bath, to supply the proper conditions for the digestion of the water residue in the citrate solution. A suggested unit is a double-armed Burrell shaker and a serological bath. Sufficient agitation is supplied by the Burrell shaker to assure intimate mixing of the residue and citrate solution. A double-armed shaker is specified, since it is necessary to agitate the molybdate precipitate constantly for 30 minutes at room temperature to obtain the correct phosphomolybdate precipitate.

Potash Determination

In this analysis, application of the Sodium Tetra Phenol Boron Method has eliminated practically all need for special equipment. The method has been standardized around the use of volumetric flask, funnels, graduates and burettes. The only actual equipment needed is a 110-volt, moderate sized hot plate for digesting the sample.

General Laboratory Equipment

To operate the proposed laboratory, it is necessary to have a supply of distilled or demineralized water. To avoid the expense of an actual still, it is suggested that water be demineralized through a demineralizer using a type "M" cartridge. Water thus treated does not interfere with any of the determinations.

A chainomatic balance with magnetic damper is of sufficient accuracy to give the desired sample weight accuracy for the determinations in question.

A Tyler screen shaker, of the small laboratory type, operated on 110-volt electricity, will give sufficiently reproducible screen analysis of the fertilizer product to allow control over the process during manufacture.

General Comments

It should be noted that materials in process may vary somewhat from the cured material prepared for shipment, and some judgment is required in evaluating the quickly determined results of the processed material.

Following installation of the laboratory, it is suggested that a consultant be retained to be sure personnel follow the established procedures, and correctly interpret

results. After a few months an occasional phone contact may be all that should be required,—just in case.★★

SELLING FERTILIZER

(*From Page 41*)

able planning, and complete indoctrination and training of IMC's sales force. In training its own men, the company drew freely on every means of stimulating interest and active participation in the program. Such devices as contests, films, dramatic costumes and motifs, pep talks, visual demonstration aids, sound effects, even a Full Orbit song, — helped to unify the staff behind and with the program, and give them a feeling of being an active part of it. Attendants at the past two NPFI conventions, by the way, have had considerable first-hand experience with the Full Orbit program in action.

In training staff to carry out the program, a Full Orbit sales manual (along with several other manuals on the specific IMC services) was prepared, which incidentally made very extensive and intelligent use of many of the findings turned up by the National Plant Food Institute in its recent survey to determine the general characteristics of American farmers, and what motivates them to buy fertilizer.

Much of the success of the Full Orbit program, can be attributed to Leonard W. Gopp, recently appointed vice president in charge of sales, for the new Agricultural Chemicals Division, and Anthony Cascino, vice president of marketing, under whose supervision, the program was conceived and "blasted off". Operating under the aggressive leadership of president Thomas Ware, IMC is setting new sales marks in the fertilizer industry.★★

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THE NEW JERSEY ENTOMOLOGICAL CLUB is holding a Fall Family Picnic at Hacklebarney State Park in Morris County on Oct. 10.

TRADE CREDIT

(*From Page 40*)

to wholesale distributors trading on their own accounts.

Most firms responding to the survey said they grant trade credit because they can increase their sales with it, because competitors do it, and because farmers want the credit service. With trade credit, of course, manufacturers can earn income from increased sales and from interest charges which exceed their total costs for the credit service rendered.

Although manufacturers use trade credit to increase their sales as such, another ultimate goal is to achieve minimum costs through high volume operations. This has special importance to them because crop production is extremely seasonal: Three-fourths of the fertilizer produced is consumed between January and June. With plant capacity excessive for fall operations, a firm's capital costs per ton can go very high if spring tonnage is low. To the extent that a firm can use trade credit to build tonnage, to achieve lower costs per unit, and to reflect them in lower sales prices, all parties benefit.

Finally, farmers prefer to use trade credit for buying fertilizer: It is easily obtained because crop to be grown serves as security; it supplements their operating capital; and sometimes their creditors provide them with a marketing service, such as ginning cotton.

Fertilizer manufacturers obtain funds to finance their trade credit from several sources. Most of the respondents said they finance their credit sales largely from internal funds; several specifically said that they can profitably use their own working capital for trade credit. Manufacturers also use credit from others to supplement their internal sources of funds. They obtain some trade credit from their suppliers, whose terms

usually are 30 days net. Small- and medium-size plants rely partially on commercial banks for the short-term financing needed for carrying their inventory and accounts receivable through their peak season.

More of the fertilizer sold in the states covered in the report could be financed with bank credit to farmers, according to data from the survey. Some farmers actually would save money by using bank credit. Nevertheless, a major shift from trade credit to bank credit is unlikely, since manufacturers do not change their credit policies frequently or dramatically. Most of the firms responding in the survey said they had followed their current credit policies for more than five years. Presumably they will continue to give their customers open-book credit freely. Moreover, in the last five years manufacturers have advanced trade credit direct to more farmers, partly because farms have become fewer and larger in their trade areas. Some firms said their credit sales direct to farmers will grow because farmers need more working capital and larger advances, which they will seek from fertilizer plants. Sales through agents and distributors probably will decline, the report said.★★

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JESSE H. HALLOWELL has been named Boston sales division manager for the U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., New York. He replaces Edward C. Richardson, who now is U. S. I. manager of Chicago sales.

AC

DEALERS TRUCK EQUIPMENT Co., Shreveport, La., is a new distributor for the Highway Equipment Co., Cedar Rapids, Iowa. They serve the state of Louisiana except for the eastern section.

AC

DR. DONALD B. PFLEIDERER has joined the agronomic service staff of the American Agricultural Chemical Co., New York. He is located at AAC's Agrico office in Detroit.

FERTILIZER TECHNOLOGY

(*From Page 49*)

and on the Pacific Coast is of very recent origin. The underlying factors responsible for the large upsurge in fertilizer consumption have already been referred to. The heavy demand for foods and fibers created by war undoubtedly were a sharp spur to increased usage and the improvements in the use of pesticides and varieties of crops complemented the effects of fertilizer. Federal acreage control and ACP payments to farmers as reimbursement for purchased fertilizer used on soil conserving crops were other significant factors favoring increased consumption. Unquestionably one of the principal factors favoring an increase in the use of fertilizers has been the low cost of plant food relative to the other factors of farm input. According to the U.S. Department of Agriculture (5), the cost of all fertilizers in 1957 based on 1935-39 prices had increased 48% while feed prices increased 100%, farm machinery 116% and wage rates 346%.★★

(5) The Farm Cost Situation, USDA, NOV. 1957.

AGRONOMIC NEEDS

(*From Page 34*)

value in the feed or food product. On the contrary, in most cases it is desirable to have feed stuffs rich in nitrogen (protein) and phosphorus. The absorption of large amounts of potassium by plants in excess of that required for vegetative growth, and seed production is a luxury that the farmer can ill afford.

Research has shown that many plants are vigorous feeders on K when it is present in the substrate, regardless of need. Grasses are strongly competitive in this respect. Data by Rouse and co-workers* show that some forage species ab-

*Rouse, R. D. and Parks C. L. "Potassium Content and Forage Yield as affected by Fertilization." *Better Crops With Plant Food.* March 1958.

sorb 5 times the amount of K needed for maximum growth, Figure 5. In these studies, less than one per cent K was required for 10 species to make maximum yields. Even some legumes, which are sensitive to K levels in the soil, needed less than one per cent K on a dry weight basis. Alfalfa which needed about 1.0 per cent K, absorbed over 3 per cent, and vetch which needed about 1.5 per cent absorbed over 5 per cent potassium.

This luxury absorption of potassium actually is toxic to some species. Annual lespedeza absorbed nearly 2 per cent K where large amounts were available, but the yields were severely retarded above one per cent K level in the plant, Figure 6. This was not a salt effect on seedling establishment, but was a toxic effect on the metabolism of the growing plant. Then, there is the toxic effect of excessive K on the quality of some plant products. A serious reduction in the percentage of sound and mature kernels in runner peanuts was found to result from the application of 120 pounds of K_2O per acre in Alabama tests. (Table 6). In this case, additional lime failed to prevent the reduction in shelling percentage, although a Ca to K antagonism is recognized. The extra potash was added as a top dressing to avoid injury to the peanut seedlings.

A serious practical problem with the use of the highly soluble potassium salts, as well as some nitrogen carriers, is the toxic effects of high salt concentrations on seedling plants. Placement of these fertilizers to avoid injury to the germinating seed and young seedling and yet obtain efficient use of the fertilizer presents a difficult problem with a number of crops. The soybean is a good example. On many soils it is necessary to recommend broadcast applications of fertilizer for soybeans because of the toxic effects of relatively small amounts of KCl in the drill row, Figure 7. Perhaps one reason that peanuts and soybeans are known as the "unpredictable legumes" is that salt damage is frequently encountered with the forms of potash used as fertilizer for these plants.

This poses the practical and very important question of how to increase the efficiency of use of potassium as a fertilizer. In addition to being absorbed in luxury amounts, the readily soluble forms are subject to serious leaching losses on sandy soils. Because of luxury consumption and leaching losses, on many soils it appears advisable to fertilize a perennial such as alfalfa after each cutting of hay.

Researchers in fertilizer development will make a major contribution if they can develop an economic source of slowly soluble potassium.

Minor or Secondary Elements

THE development of iron chelates will serve to illustrate the tremendous potentialities in this field. If one can visualize plants absorbing a molecule like ferric ethylene diamine tetraacetate (which they do), it should not be too difficult to see the possibilities in this area of minor element nutrition. It appears that organic molecules of varying sizes enter plant roots. As evidence of this, antimetabolites and growth inhibitors have been observed to affect cellular activities immediately when plant roots are immersed in solutions of these compounds. Nutrient elements other than iron, needed in small quantities by plants, should be made available in forms that are more effective and more efficient than those used at present. The incorporation of boron into slags and glass is an example of progress in this field. Minor element nutrition is certain to become more of a problem with increased use of high analysis fertilizers and continued exhaustion of the organic matter content of our soils.

In conclusion, from the standpoint of the agronomist, the needs appear great and the opportunities challenging in this field of fertilizer improvement through further research and development.★★

SEWAGE SLUDGE

(*From Page 64*)

of sludge as high as 150 to 250 cu. yds. per acre can be used under some conditions, especially for such crops as grains and grasses even on acid soils. However 50 cu.yds. is a safer rate.

Where the crop requires a fairly to strongly acid soil, the application of sludges for soil improvement must be made with caution, if at all. This is particularly true where the response of the crop to relatively high concentrations of copper and zinc is unknown. Light applications, i. e. 15 or 20 cu. yds. per acre, may be permissible.

The Connecticut State Department of Health does not advocate the use of fresh digested sludge on crops that are to be eaten raw. If the sludge is applied and worked into the soil six months or so prior to seeding such a crop, no health hazard is involved.★★

Connecticut Experiment Station Bulletin 622. Report by Herbert A. Lunt.

PEST ROUNDUP

(*From Page 73*)

earworm or soybeans in Virginia. By the latter part of the month, soybeans in the eastern and southeastern parts of the State were being heavily damaged by larval defoliation, destruction of pods and feeding on flowers. Controls were needed in many cases and unless applied the situation was expected to become extremely serious.

The green cloverworm was also responsible for some soybean damage in southeastern Virginia and on the Virginia Eastern Shore and was prevalent on the crop in Kent and Sussex Counties, Delaware. Illinois, Missouri and Nebraska reported the insect attacking soybeans in various degrees of intensity. In eastern South Carolina, a combination of lepidopterous larvae were responsible for an outbreak on soybeans which, by the first of September, appeared to be developing rapidly.

Corn leaf aphids continued to be heavy in several areas during August. States reporting unusually high populations of the insect included Delaware, Ohio, Indiana, Minnesota, North Dakota, Utah, Idaho, California and Arizona.

Lygus bugs were causing grave concern to cotton growers in Arizona during August. The pests were a problem throughout the cotton growing areas of the entire state, and in some sections heavy reduction in yield was expected. Counts of punctured squares ranged from 20-60 per cent. Some areas of California also reported economic populations.★★

ARTHUR M. MOORE has been appointed product sales manager for chemicals by the Escambia Chemical Corp., New York.

CLASSIFIED ADVERTISING

Address all classified replies to Box Number, c/o Agricultural Chemicals, P. O. Box 31, Caldwell, N. J.
Rates for "Help Wanted" advertisements are 20¢ per word; minimum charge $3.00. Rate for individuals seeking employment is 5¢ per word, $1.00 minimum.
Advertisements of new machinery, products and services accepted at rate of $10.00 per column inch. Minimum space, one inch.
Copy closing date, 10th of preceding month.
Checks must accompany all orders.

Help Wanted:

WANTED—Manager for large fertilizer plant — North Midwest Area — Plant is large granulation plant with superphosphate facilities. Give complete resume of age, education, experience and availability in first letter. Address Box 246, c/o **Agricultural Chemicals.**

MIDWEST MANUFACTURER wants chemist with formulation background and biologist or botanist with field research experience. Write Box 247, c/o **Agricultural Chemicals.**

For Sale:

$3,000,000 LIQUIDATION CHEMICAL PLANT AT ORANGE, TEXAS. Type 316 Stainless Steel Tanks, Kettles, Heat Exchangers, Columns, Stills, Crystallizers, Centrifugals, Pumps, Valves, etc. Wonderful values. Send for list. Perry Equipment Corp., 1428 N. 6th St., Phila. 22, Pa.

FOR SALE: 1800 cu. ft. T304 SS weigh hoppers. (3) 18,000 gal. Alum. tanks. (10,000')—T316 SS pipe—1", 2", 3" up to 12". Perry Equipment Corp., 1428 N. 6th St., Phila. 22, Pa.

Situations Wanted:

DESIRE TO RELOCATE in South East. Over 12 years experience with the same firm in sales and sales management of fertilizer and pesticide materials. Presently employed assistant management position administrating sales and activities of over 50 people. Present volume of around 20 million. Compensation commensurate with performance. Reply Box 244, c/o **Agricultural Chemicals.**

AGRONOMIST (ing.agr.ETH), Swiss, age 36, 10 years experience in testing and marketing plant protection products, practice in Europe, Middle East, Africa and South America. Languages: German, French, English, Italian, Spanish, desires responsible executive position in Europe or overseas on technical or sales side of progressive concern. Apply box OFA 16825 A, Orell Fussli-Annonces, Basle/Switzerland.

EXCELLENT 10 YEAR RECORD in sales management, sale of insecticide and fertilizer. M.S. degree in Agronomy and Agricultural Chemistry. Outstanding references. Desires new opportunity. Address Box 245, c/o **Agricultural Chemicals.**

Miscellaneous:

KILL BRUSH at low cost with amazing R-H BRUSH RHAP. Will not injure grasses, grains; not poisonous. For free information write Reasor-Hill Corporation, Box 36AC, Jacksonville, Arkansas.

KILL SUBMERGED WATER WEEDS which foul up motor propellers, tangle fishing gear, with R-H WEED RHAP-20, Granular 2,4D. Inexpensive, easy to use, sure results. For free information write Reasor-Hill Corporation, Box 36AC, Jacksonville, Arkansas.

MR. CORN FARMER: Control broad leaved weeds and grasses (crab grass, fox tails) with R-H WEED RHAP-20, Granular 2,4-D. For free information write Reasor-Hill Corporation, Box 36AC, Jacksonville, Arkansas.

ZONOLITE VERMICULITE —a free-flowing, highly absorptive, inorganic, lightweight carrier for any type chemical. Low density. Cuts carrier costs. Formulates without caking or balling up. Technical information and assistance to help you work out new formulae on confidential basis. Also working samples, prices. Dependable service and supply from over 40 ideally located Zonolite plants.
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GOBIND MAKHIJANI has been appointed a formulator in the insecticide laboratory of the Nopco Chemical Co., Newark, N.J. A native of Pakistan, Mr. Makhijani came to the U. S. three years ago. He has been associated with Foster D. Snell and Geigy.

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Caldwell, New Jersey

INDEX to ADVERTISERS

TALE ENDS

COTTON pests are reported to have increased tolerance to chlorinated hydrocarbon insecticides in test studies conducted during 1958 by USDA pesticide research workers. Tolerance of the boll weevil both to dieldrin and toxaphene increased so markedly, it is reported, that satisfactory control of heavy infestations was impossible in '58 test work. Entomologists have been arguing the point for the past several seasons, as to whether resistance is actually developing among cotton pests, or whether unsatisfactory control may simply have resulted from employing "too little, too late," as some of the pesticide producers have charged. The latter, incidentally, say that the '59 results will differ markedly from '58 tests, so we can assume that the debate will continue as to whether there is, or there ain't, resistant cotton pests.

AC

The spotted alfalfa aphid is another pest that has been giving control experts a headache this season. This pest was less of a problem in California growing areas in '58. Low aphid populations this spring resulted in a decline in the predator population, according to Univ. of Calif. entomologists, and it inevitably followed that the alfalfa aphid came back stronger than ever in certain areas. Systemics were employed, to give the predator population a chance to restore itself.

AC

Restrictions will be placed by Germany on residues of pesticides and other residues on citrus fruit imported into the country in a new law which will become effective December 23. Regulations may, in effect, ban the import of citrus fruit on which pesticide residues remain or which has been colored or waxed. Shipments from the U. S. could be seriously affected. Citrus growers in Israel and Argentina claim they use no pesticides on their output, but of this U. S. growers are highly skeptical.

AC

There are still a lot of misconceptions in the minds of many farmers about soil testing. Not all realize that, to mean anything, soil tests have to be repeated at regular intervals. This isn't a situation where the job, done once, is done forever. It was brought out forcefully in a panel discussion at the ACS meeting last month that, particularly during periods of heavy rainfall when leaching can deplete nutrient content of the soil rapidly, there can be a tremendous variation in soil fertility over a period of just a few weeks. The soil test, it was emphasized, is merely a temporary guide. The whole history of the soil must be studied over a continuing period, and this means repeated, periodic tests.

AC

Soil tests proved essential in a recent problem which developed along one of the new turnpikes. A high percentage of the trees planted in one area died. Subsequent tests disclosed that the soil in certain areas showed signs of arsenic or lead poisoning. In a similar case one of our better known soil technologists told of a personal experience in his own back yard garden. He was burning leaves, grass, trash, etc. in the preparation of a mulch, and spreading the ashes on the garden. Two years in a row the plants and flowers, so treated, wilted and died. Upon pulling up several of the plants he found tiny aluminum particles (from kitchen aluminum foil) on the roots, which had caused aluminum poisoning.

AC

The U. S. Government may buy as much as sixty million pounds of DDT in 1950 for the world-wide anti-malarial program.

AC

Another insect photographic salon will be conducted by the Entomological Society of America at its meeting in Detroit, Nov. 30-Dec. 3. Entomologists and nature photographers throughout the world have been invited to submit photographs of insects, spiders and related arthropods. Write to L. D. Christenson, U.S.D.A., Beltsville, Md., for entry blanks.

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P. E. Cloutier, Bermuda, La. *"We set one of our best crops last year, and we think the toxaphene, toxaphene-DDT insect control program was a big factor. We're basing our 1959 program on the same plan . . ."*

D. L. Hall, Eudora, Ark. *"The toxaphene and toxaphene-DDT control program certainly worked for me, and made me money . . ."*

Morris A. Roberson, Gilliam, La. *"I like the early production and early harvest that comes with the toxaphene insect control program. We had good control all season, and I plan to use the same program this year . . ."*

W. E. Moore, Sherrill, Ark. *"We were able to pick cotton two weeks earlier on the acreage where we followed this program. It really paid off for us . . ."*

Clarence R. Smith, Cleveland, Miss. *"We believe in this program. It gave us excellent insect control, saved us money, and helped us make a cotton crop under adverse conditions . . ."*

H. C. Bradney, Montrose, Ark. *"This program saves me expensive late-season applications and does an excellent job. Last year I cut my insect control costs in half . . ."*

O. L. Garmon, Jr., Marks, Miss. *"I used the toxaphene program on more than 700 acres of cotton. I know you need to get the overwintered boll weevil, and this program does that. I had good insect control all year . . ."*

O. L. Cox, Ruleville, Miss. *"I got on the toxaphene program early in the season and continued on a regular schedule. I believe those six early applications paid more dividends than anything we did with our cotton crop all year long . . ."*

Insecticide salesmen have to do more than just take orders for dusts and sprays. In the Mid-South, for example, progressive formulators and dealers are showing cotton farmers how a planned, season-long insect control program based on toxaphene can be the most satisfactory—and profitable—practice. These statements from farmers already following such a program reflect the growing interest in more effective use of insecticides.

R-53-M

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